DRAFT Management Action Evaluation

Management Action Title: MA-001

Enlarge existing transitory floodplain storage.

Description:

Problem:

Currently, there is insufficient flood management storage available in some existing flood management reservoirs to regulate flood flows to the extent needed/desired. Transitory floodplain storage areas can help regulate flood flows by attenuating or reducing the magnitude of flood peaks occurring in downstream channels.

Desired Outcome:

Reduce or attenuate flood peaks by increasing available transitory flood management storage downstream from the flood management reservoirs.

Methodology:

Transitory storage occurs when peak flows in a river are diverted to adjacent off-stream storage areas. Once flow in the river decreases, water in the transitory storage area flows back into the river channel. Transitory storage measures could be attained by natural means, such as flows overtopping a bank and flowing into a wetland, or could be engineered using weirs and bypasses to direct flows onto adjacent lands. Transitory storage measures may involve flood attenuation both locally and downstream from the storage area. Enlargement of existing transitory storage areas may involve new or modified outfall structures and weirs, or modifications to berms or training dikes to increase available storage area. Transitory storage could also provide opportunities to restore ecosystem functions or habitats. For example, allowing overland flows could promote natural erosion and deposition processes and provide opportunities for riparian habitat restoration; wetland, shallow water, or terrestrial habitats.

CVFPP Goals

Contributes Significantly to: Improve Flood Risk Management

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☑ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☑ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained; requires further evaluation to identify existing transitory storage areas with potential for enlargement or reoperation

Advantages:

- Works well in conjunction with other MAs that increase system capacity and/or strengthen levees.
- Promotes multiple benefits in addition to flood flow reduction (ecosystem functions, habitat, groundwater recharge).
- Increased storage provides greater flexibility to adapt to changing climate conditions.
- Moderate cost.

Disadvantages:

- Few existing transitory storage sites may be suitable or socially acceptable for expansion.
- Cost of additional land may be high.
- Potential aquatic or terrestrial environmental impacts in expanded storage area.
- Potential impacts to existing land uses within expanded transitory storage area.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Moderate to low initial investment, depending on location and extent of required modifications to enlarge existing transitory storage (cost factors include real estate acquisitions, relocations, mitigations cost, and complexity of any structural

modifications)

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Potential for small increase in O&M costs in existing transitory storage areas

Potential for Cost-Sharing?

Potential for Federal cost sharing via contributions to existing federal project purposes (flood management, water supply, and/or environmental restoration)

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Potential to reduce long-term costs for emergency response and recovery through reduction in the frequency or magnitude of flooding

Flood fighting? (Increase, Decrease, or No Significant Change)

Potential to reduce the frequency (and long-term cost) of flooding.

Effect on Damage to Critical Public Infrastructure?

Location-specific, but may reduce damage to infrastructure in rivers and tributary areas. However, damage in existing transitory floodplain may increase.

Effect on Floodplain and Economic Development?

No significant direct effects; however, reduces the frequency of flooding and increases level of flood protection, which may encourage development in floodplain areas receiving benefits

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential to reduce State flood responsibility by reducing the frequency of flooding

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

Could help rehabilitate physical processes and ecological functions if transitory storage is located in historical floodplains or flood basins (enhancing floodplain forming processes, increasing salmonid rearing and Sacramento splittail spawning habitat)

Adverse Environmental Impact?

If transitory floodplain storage is expanded into areas that are not active or historical floodplains or floodbasins, could result in moderate to substantial permanent impacts to terrestrial, agricultural, and potentially seasonal wetland habitats (including potential loss of habitat for special-status species)

Permitting Considerations?

Expansion of existing transitory storage areas would require new or modified permits

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

Lower flows downstream would result in decrease in required O&M and attendant environmental impacts.

Social Considerations:

Public Safety?

Reduces frequency of flooding and improves level of flood protection; no residual risk (as would be associated with similar benefits provided by levees or other downstream features)

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to contribute to restoration of floodplain functions and habitats. Potential to contribute to groundwater recharge. Possibility for creating new recreational or open space areas.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Expanding existing transitory storage would generally have a higher likelihood of implementation than constructing other types of new on- or off-stream storage, but some institutional and political challenges exist

Technical Considerations:

Redirected Hydraulic Impacts?

No redirected downstream impacts; potential local hydraulic impacts within transitory storage inundation area

Residual Risk?

Reduces the frequency of flooding, reducing residual risk to existing development

Climate Change Adaptability:

Increased transitory floodplain storage would enhance hydrologic adaptability by increasing water management flexibility; could enahnce biological adaptability if transitory storage is located in historical floodplains or floodbasins (increasing the ability of aquatic and floodplain species to adjust to changing climate conditions)

Urban, Small Community, and Non-Urban Considerations:

Existing transitory storage is in non-urban areas

Regional Applicability:

Varies by region; more applicable upstream from Delta Region.

Integration with Other Programs:

References:

USACE 2001 Sacramento and San Joaquin River Basins Comprehensive Study;

DRAFT Management Action Evaluation

Management Action Title: MA-002

Construct new transitory floodplain storage.

Description:

Problem:

Currently, there is insufficient flood management storage available in some existing flood management reservoirs to regulate flood flows to the extent needed/desired. Transitory floodplain storage can areas help regulate flood flows by attenuating or reducing the magnitude of flood peaks occurring in downstream channels.

Desired Outcome:

Reduce or attenuate flood peaks by increasing available transitory flood management storage downstream from the flood management reservoirs.

Methodology:

Transitory storage occurs when peak flows in a river are diverted to adjacent off-stream storage areas; once flow in the river decreases, water in the transitory storage area flows back into the river channel. Transitory storage measures could be attained by natural means, such as flows overtopping a bank and flowing into a wetland, or could be engineered using weirs and bypasses to direct flows onto adjacent lands. Transtiory storage measures may involve flood attenuation both locally and downstream for the storage area. There may be opportunities to establish new transitory storage in existing floodplains or areas that experience frequent flooding. Wildlife refuges, certain types of rural or agricultural lands, and certain Delta islands may be suitable for use as transitory storage. Transitory storage could also provide opportunities to restore ecosystem functions or habitats. For example, allowing overland flows could promote natural erosion and deposition processes and provide opportunities for riparian habitat restoration; wetland, shallow water, or terrestrial habitats. New transitory storage would likely include control facilities such as weirs to control the stage in the river at which the storage begins to operate, and also controls the flow rate into the storage area.

CVFPP Goals

Contributes Significantly to: Improve Flood Risk Management

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☑ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained; requires further evaluation to identify locations where it is feasible to develop new transitory storage

Advantages:

- Works well in conjunction with other MAs that increase system capacity and/or strengthen levees, restore floodplain functions.
- Promotes multiple benefits in addition to flood flow reduction (ecosystem functions, habitat, groundwater recharge).
- Increased storage provides greater flexibility to adapt to changing climate conditions
- Moderate cost.

Disadvantages:

- New transitory storage sites may be scarce/limited due to social acceptability and cost.
- Potential aquatic or terrestrial environmental impacts in new storage area.
- Potential impacts to existing land uses within new storage area.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Moderate to low initial investment, depending on location and extent of construction required to develop new transitory storage (cost factors include real estate acquisitions, relocations, mitigations cost, and complexity of new facilities)

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

O&M costs would be assoicated with any new transitory storage facility; cost would likely be low compared with other actions providing similar benefits.

Potential for Cost-Sharing?

Potential for Federal cost sharing via contributions to existing federal project purposes (flood management, water supply, and/or environmental restoration)

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Potential to reduce long-term costs for emergency response and recovery through reduction in the frequency or magnitude of flooding

Flood fighting? (Increase, Decrease, or No Significant Change)

Potential to reduce the frequency (and long-term cost) of flooding

Effect on Damage to Critical Public Infrastructure?

Infrastructure in the new storage area will be affected.

Effect on Floodplain and Economic Development?

No significant direct effects; reduces the frequency of flooding and increases level of flood protection, which may encourage development in floodplain areas receiving these benefits; potential to change existing uses of land within the new storage area

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential to reduce State flood responsibility by reducing the frequency of flooding

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

Could help rehabiliate physical processes and ecological functions if new transitory storage is located in historical floodplains or flood basins (enhancing floodplain forming processes, increasing salmonid rearing and Sacramento splittail spawning habitat)

Adverse Environmental Impact?

If new transitory floodplain storage is created in areas that are not active or historical floodplains or floodbasins, could result in moderate to substantial permanent impacts to terrestrial, agricultural, and potentially seasonal wetland habitats (including potential loss of habitat for special-status species)

Permitting Considerations?

Potentially extensive or complex permitting, depending on location.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Reduces frequency of flooding and improves level of flood protection; no residual risk (as would be associated with similar benefits provided by levees or other downstream features)

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to contribute to restoration of floodplain functions and habitats.Potential to contribute to groundwater recharge.Possibility for creating new recreational or open space areas.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Developing new transitory storage would generally have a higher likelihood of implementation than constructing other types of new on- or off-stream storage, but some institutional and political challenges exist (land use changes, O&M responsibilities, others)

Technical Considerations:

Redirected Hydraulic Impacts?

No redirected downstream impacts; potential local hydraulic impacts within transitory storage inundation area

Residual Risk?

Reduces the frequency of flooding, reducing residual risk to existing development

Climate Change Adaptability:

New transitory floodplain storage would enhance hydrologic adaptability by increasing water management flexibility; could enahnce biological adaptability if transitory storage is located in historical floodplains or floodbasins (increasing the ability of aquatic and floodplain species to adjust to changing climate conditions)

Urban, Small Community, and Non-Urban Considerations:

New transitory storage facilities will need to be sited in non-urban areas such as wildlife refuges or agricultural areas.

Regional Applicability:

Varies by region; more applicable upstream from Delta Region.

Integration with Other Programs:

Flood Corridors Program (Projects Office)

References:

Comment on Regional Conditions Report; Yolo Bypass Management Strategy; Delta Risk Management Strategy; Hegedus and Shibatani, 2009; Independent Review Panel to the California Department of Water Resources, 2007;

DRAFT Management Action Evaluation

Management Action Title: MA-003

Increase on-stream flood storage capacity by building new storage facilities.

Description:

Problem:

There is insufficient flood management storage available in some existing flood management reservoirs to regulate flood flows. The addition of new on-stream flood management storage capacity in appropriate watersheds could reduce downstream flood releases.

Desired Outcome:

Increase available flood management storage capacity by constructing a new on-stream reservoir.

Methodology:

A new flood management reservoir could be constructed on an uncontrolled stream in a watershed, such as the South Fork of the Yuba River, that already contains a flood management reservoir; it could be constructed upstream or downstream from an existing flood management reservoir; or it could be constructed in a watershed that has no existing flood management reservoirs. Constructing a new flood management reservoir in any of these locations would provide additional flood management storage to allow better management of flood flows to decrease the probability of releasing damaging flows downstream.

CVFPP Goals

Contributes Significantly to: Improve Flood Risk Management

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☑ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained, but requires further evaluation to identify candidate on-stream sites where developing a new flood management reservoir is feasible.

Advantages:

- Will work well in conjunction with other MAs that increase downstream system capacity and/or strengthen levees.
- May promote multiple benefits in addition to flood flow reduction (water supply, cold water pool for fisheries management, recreation).
- Increased storage provides greater flexibility to adapt to changing climate conditions.

Disadvantages:

- Potentially very high capital cost.
- Potentially high impacts to terrestrial and other environmental resources in reservoir inundation area.

Economic Considerations:

Capital Cost? (High, Medium, Low)

High initial investment, depending on location and size of new on-stream storage (cost factors include real estate acquisitions, relocations, mitigations cost, and complexity of dam facilities)

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

O&M costs from new dam facilities must be considered.

Potential for Cost-Sharing?

Potential for Federal cost sharing via contributions to existing federal project purposes (flood management and/or water supply).

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Potential to reduce long-term costs for emergency response and recovery through reduction in the frequency or magnitude of flooding.

Flood fighting? (Increase, Decrease, or No Significant Change)

Potential to reduce the frequency (and long-term cost) of flooding

Effect on Damage to Critical Public Infrastructure?

Potential to reduce damage.

Effect on Floodplain and Economic Development?

No direct effects; however, reduces the frequency of flooding and increases level of flood protection, which may encourage development in the floodplain

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential to reduce State flood responsibility by reducing the frequency of flooding

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

Negative impact likely.

Adverse Environmental Impact?

Substantial permanent impacts to aquatic and riparian habitat including loss of habitat and habitat connectivity (e.g. fish migration) for special-status species; substantial alteration of physical processes, including flow regime (e.g., seasonality, magnitude, and duration of flows) and sediment transport, that would result in permanent impacts to habitat for aquatic and riparian species.

Permitting Considerations?

Extensive and complex permitting required.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Reduces frequency of flooding and improves level of flood protection; no residual risk (as would be associated with similar benefits provided by levees or other downstream features)

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to contribute to water supply, hydropower, recreation, and fisheries management if storage is maintained after flood season.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Developing new on-stream storage would generally have a much lower likelihood of implementation than expanding existing on- or off-stream storage. Institutional and political challenges would be severe.

Technical Considerations:

Redirected Hydraulic Impacts?

No redirected downstream impacts; potential hydraulic impacts within reservoir inundation area.

Residual Risk?

Reduces the frequency of flooding, reducing residual risk to existing development.

Climate Change Adaptability:

This action would enhance hydrologic adaptability by increasing water management flexibility; and it could reduce biological adaptibility by reducing the quantity and connectivity of habitat, which would reduce the ability of species to handle and adjust to the consequences of climate change.

Urban, Small Community, and Non-Urban Considerations:

Non-urban area for location.

Regional Applicability:

Not applicable in Delta Region, but may be used to reduce hydraulic impacts to Delta.

Integration with Other Programs:

References:

USACE 2001 Sacramento and San Joaquin River Basins Comprehensive Study; RCR; Boyle & Associates, 2008. Madera County Integrated Regional Water Management Plan; Mokelumne/Amador/Calaveras IRWMP - Draft. November, 2006; Colusa Basin IRWMP;

DRAFT Management Action Evaluation

Management Action Title: MA-004

Update/modify existing flood storage facilities.

Description:

Problem:

Certain existing dams may have been built to different standards and sizes or for different purposes than those required today, or they may be aging to the point that O&M and safety considerations suggest retrofit or replacement. Replacement of an existing dam can provide increased safety, storage, and operational flexibility for flood operations. Retrofit of an existing dam can provide operational flexibility.

Desired Outcome:

Increase public safety, flood management storage, and systemwide operational flexibility by replacing or retrofitting aging or obsolete dams.

Methodology:

The Central Valley has a long history of replacing obsolete dams (i.e. New Bullards Bar, New Melones, etc.). Replacing a dam could be done by constructing a new dam either upstream or downstream from the existing dam, and then decommissioning or removing the old dam when the new one is completed. The new dam is often significantly larger than the existing dam, thus providing additional flood management storage to improve the operations and reduce flood flows. Retrofitting a dam could include a new spillway, such as the one at Folsom Dam that allows release of larger inflows before it is necessary to start storing water prior to flood operations.

CVFPP Goals

Contributes Significantly to: Improve Flood Risk Management

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☑ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained, but requires further evaluation to identify candidate reservoirs where additional storage could be provided by replacing an aging or obsolete dam.

Advantages:

- Will work well in conjunction with other MAs that increase downstream system capacity and/or strengthen levees
- Promotes multiple benefits in addition to flood flow reduction (water supply, cold water pool for fisheries management)
- Increased storage provides greater flexibility to adapt to changing climate conditions

Disadvantages:

- Potentially high capital cost.
- Potential terrestrial environmental impacts in reservoir inundation area.
- Potential to reduce downstream floodplain habitat by reducing peak flows.

Economic Considerations:

Capital Cost? (High, Medium, Low)

High initial investment, depending on location and size of replacement dam (cost factors include real estate acquisitions, relocations, mitigations cost, and complexity of replacing existing dam facilities with new)

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Potential to reduce O&M costs by relacing aging or obsolete dam

Potential for Cost-Sharing?

Potential for Federal cost sharing via contributions to existing federal project purposes (flood management and/or water supply).

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Potential to reduce long-term costs for emergency response and recovery through reduction in the frequency or magnitude of flooding.

Flood fighting? (Increase, Decrease, or No Significant Change)

Potential to reduce the frequency (and long-term cost) of flooding

Effect on Damage to Critical Public Infrastructure?

Region specific (cannot determine at this time)

Effect on Floodplain and Economic Development?

No direct effects; however, reduces the frequency of flooding and increases level of flood protection, which may encourage development in the floodplain

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential to reduce State flood responsibility by reducing the frequency of flooding

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

None

Adverse Environmental Impact?

Substantial temporary impacts to aquatic and riparian habitat would result from dam replacement. Increasing the storage (flooding additional area) would result in substantial permanent impacts to upland and potentially seasonal and/or freshwater marsh wetland habitat including loss of habitat for special-status species; and would result in moderate alteration of physical processes, including flow regime (e.g., seasonality, magnitude, and duration of flows) and sediment transport, that could result in permanent impacts to habitat for aquatic and riparian species.

Permitting Considerations?

Extensive and complex permitting required.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Reduces frequency of flooding and improves level of flood protection; no residual risk (as would be associated with similar benefits provided by levees or other downstream features)

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to contribute to water supply, hydropower, recreation, and fisheries management

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Replacing an existing dam would generally have a higher likelihood of implementation than constructing a new on-stream storage, but institutional and political challenges still exist.

Technical Considerations:

Redirected Hydraulic Impacts?

No redirected downstream impacts; potential hydraulic impacts within reservoir inundation area.

Residual Risk?

Reduces the frequency of flooding, reducing residual risk to existing development.

Climate Change Adaptability:

An increase to the water storage would enhance hydrologic adaptability by increasing water management flexibility.

Urban, Small Community, and Non-Urban Considerations:

No specific considerations identified.

Regional Applicability:

May be applied in regions where dams exist. May be used to reduce hydraulic impacts to Delta.

Integration with Other Programs:

References:

Mokelumne/Amador/Calaveras IRWMP - Draft. November, 2006;

DRAFT Management Action Evaluation

Management Action Title: MA-005

Create new storage in existing reservoirs via dredging activities.

Description:

Problem:

Due to location and/or watershed characteristics, many reservoirs have reduced capacity resulting from sediment accumulation within the reservoir.

Desired Outcome:

Increase available flood management storage allocation in existing reservoirs.

Methodology:

Additional flood management storage could be created/restored in an existing reservoir by dredging accumulated sediments; this dredged material could be used elsewhere in the system for flood maintenance activities. Dredging operations would be properly permitted and monitored so that potential water quality impacts are minimized.

CVFPP Goals

Contributes Significantly to: Improve Flood Risk Management

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☑ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained, but requires further evaluation to identify candidate reservoirs where flood management storage has been compromised and dredging to get some of it back is feasible.

Advantages:

- Will work well in conjunction with other MAs that increase downstream system capacity and/or strengthen levees.
- Promotes multiple benefits in addition to flood flow reduction (water supply, cold water pool for fisheries management).
- Increased storage provides greater flexibility to adapt to changing climate conditions.

Disadvantages:

- Potentially high capital cost for small increase in flood storage.
- Potential severe aquatic and terrestrial environmental impacts in reservoir inundation area.
- Potential aquatic environmental impacts downstream.
- Disposal of dredged materials might be hampered by the presence of hazardous wastes such as methyl mercury in the sediment. Also, if there is no good use for the sediment within reasonable distance (reasonable transportation cost), a location for disposal needs to be found.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Moderate initial investment, depending on location and extent of dredging and availability of disposal sites (cost factors include real estate acquisitions for disposal, transportation of dredged materials, and environmental mitigation costs).

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Little or no change to O&M costs from modifications to existing dam facilities once dredging is complete.

Potential for Cost-Sharing?

Potential for Federal cost sharing via contributions to existing federal project purposes (flood management and/or water supply); may be reduced due to high cost and limited benefits.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Potential to reduce long-term costs for emergency response and recovery through reduction in the frequency or magnitude of flooding.

Flood fighting? (Increase, Decrease, or No Significant Change)

Potential to reduce the frequency (and long-term cost) of flooding.

Effect on Damage to Critical Public Infrastructure?

Region specific (cannot determine at this time)

Effect on Floodplain and Economic Development?

No direct effects; however, reduces the frequency of flooding and increases level of flood protection, which may encourage development in the floodplain.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential to reduce State flood responsibility by reducing the frequency of flooding

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

Will impact existing reservoir ecology.

Adverse Environmental Impact?

This action would result in moderate to substantial temporary impacts to reservoir aquatic habitat and associated species. This action would also result in moderate alteration of downstream physical processes, including flow regime (e.g., seasonality, magnitude, and duration of flows) and sediment transport, that could result in permanent impacts to habitat for aquatic and riparian species.

Permitting Considerations?

Substantial but less complex than permitting for a new reservoir.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Reduces frequency of flooding and improves level of flood protection commensurate with increase in storage; no residual risk (as would be associated with similar benefits provided by levees or other downstream features)

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to contribute to water supply, hydropower, recreation, and fisheries management

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Conducting dredging in an existing dam to increase storage would generally have a higher likelihood of implementation than constructing new on- or off-stream storage, but environmental, institutional, and political challenges still exist.

Technical Considerations:

Redirected Hydraulic Impacts?

No redirected downstream impacts; potential hydraulic impacts within reservoir inundation area.

Residual Risk?

Reduces the frequency of flooding commensurate with increase in storage, reducing residual risk to existing development.

Climate Change Adaptability:

Enhances hydrologic adaptability by increasing water management flexibility.

Urban, Small Community, and Non-Urban Considerations:

No specific considerations identified.

Regional Applicability:

May be applied in regions where dams exist. May be used to reduce hydraulic impacts to Delta.

Integration with Other Programs:

References:

USACE 2001 Sacramento and San Joaquin River Basins Comprehensive Study;

DRAFT Management Action Evaluation

Management Action Title: MA-006

Increase flood control allocation by expanding existing, on-stream reservoirs.

Description:

Problem:

There is insufficient flood management storage available in some existing flood management reservoirs to regulate flood flows. From a flood control perspective, maintaining sufficient flood reservation space within reservoirs becomes critical during the rainy season. In the San Joaquin Valley, for example, the first flood can fill some reservoirs, and flood releases are limited by the downstream channel capacities. This increases the likelihood of spilling large flood flows during the latter part of storm events (Independent Review Panel to the California Department of Water Resources, 2007).

Desired Outcome:

Increase available flood management storage allocation in existing reservoirs.

Methodology:

Expansion of existing on-stream reservoirs may be easier and more effective to accomplish than building a new reservoir because of the lack of feasible sites for new on-stream reservoirs. Raising an existing dam and thereby enlarging the existing flood management reservoir could provide additional flood management storage allocation while at the same time maintaining or increasing conservation storage. Increasing flood management storage allocation in an existing reservoir usually comes at the expense of conservation storage, except when the existing dam is raised to increase the total storage behind the dam. The additional storage in the reservoir can be divided between conservation storage and flood management storage as needed, but the entire storage of the reservoir will be available for water supply storage after the flood season.

CVFPP Goals

Contributes Significantly to: Improve Flood Risk Management

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☑ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained, but requires further evaluation to identify candidate reservoirs where additional storage is needed and feasible.

Advantages:

- Will work well in conjunction with other MAs that increase downstream system capacity and/or strengthen levees.
- Promotes multiple benefits in addition to flood flow reduction (water supply, cold water pool for fisheries management).
- Increased storage provides greater flexibility to adapt to changing climate conditions.

Disadvantages:

- Potentially high capital cost.
- Potential aquatic and terrestrial environmental impacts in reservoir inundation area.

Economic Considerations:

Capital Cost? (High, Medium, Low)

High initial investment, depending on location and extent of expansion (cost factors include real estate acquisitions, relocations, mitigations cost, and complexity of structural modifications to existing dam facilities)

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Little or no change to O&M costs from modifications to existing dam facilities

Potential for Cost-Sharing?

Potential for Federal cost sharing via contributions to existing federal project purposes (flood management and/or water supply).

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Potential to reduce long-term costs for emergency response and recovery through reduction in the frequency or magnitude of flooding.

Flood fighting? (Increase, Decrease, or No Significant Change)

Potential to reduce the frequency (and long-term cost) of flooding

Effect on Damage to Critical Public Infrastructure?

Region specific (cannot determine at this time)

Effect on Floodplain and Economic Development?

No direct effects; however, reduces the frequency of flooding and increases level of flood protection, which may encourage development in the floodplain

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential to reduce State flood responsibility by reducing the frequency of flooding

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

More operational flexibility with increased storage, including wider range of possible downstream flow regimes.

Adverse Environmental Impact?

Expanding existing on-stream reservoirs would result in permanent impacts to aquatic and riparian habitat in the reservoir inundation area, including loss of habitat and habitat connectivity (e.g., fish migration) for special-status species. This action also would result in moderate to substantial alteration of physical processes, including flow regime (e.g., seasonality, magnitude, and duration of flows) and sediment transport, that could result in permanent impacts to habitat for aquatic and riparian species.

Permitting Considerations?

Extensive and complex permitting required.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Reduces frequency of flooding and improves level of flood protection; no residual risk (as would be associated with similar benefits provided by levees or other downstream features)

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to contribute to water supply, hydropower, recreation, and fisheries management if storage is maintained after flood season.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Raising an existing dam would generally have a higher likelihood of implementation than constructing new on-stream storage, but significant environmental, institutional, and political challenges still exist.

Technical Considerations:

Redirected Hydraulic Impacts?

No redirected downstream impacts; potential hydraulic impacts within reservoir inundation area.

Residual Risk?

Reduces the frequency of flooding, reducing residual risk to existing development.

Climate Change Adaptability:

Enhances hydrologic adaptability by increasing water management flexibility, could reduce biological adaptibility if new storage area interrupts wildlife migration corridors.

Urban, Small Community, and Non-Urban Considerations:

No specific considerations identified.

Regional Applicability:

Not applicable in Delta Region, but may be used to reduce hydraulic impacts to Delta.

Integration with Other Programs:

References:

USACE 2001 Sacramento and San Joaquin River Basins Comprehensive Study;Environmental Sustainability Summary; Mokelumne/Amador/Calaveras IRWMP - Draft. November, 2006;

DRAFT Management Action Evaluation

Management Action Title: MA-007

Increase foothill and upper watershed storage.

Description:

Problem:

There is insufficient flood management storage available in some existing flood management reservoirs to regulate flood flows. The deep empty space requirements often drive mandated releases during the flood season to maintain flood storage within the operational flood encroachment curve (Hegedus and Shibatani, 2009). The availability of additional flood storage in upper watershed reservoirs can reduce the required flood storage in the foothill flood management reservoir.

Desired Outcome:

Increase available storage in upper watershed reservoirs, upstream from flood management reservoirs.

Methodology:

When storage is available in reservoirs upstream from a flood management reservoir, that storage can often be counted as available flood storage (i.e., French Meadows and Ice House for Folsom Dam and Mammoth Pool for Friant Dam). Available storage in existing upper watershed reservoirs could be increased by allowing surcharging of the spillways, to increase the storage in the reservoir prior to spills. The use of surcharging is dependent on the design of the dam and spillway, but if it does not reduce the safety of the dam, it could be achieved through the use of temporary or permanent flashboards on top of the spillway of the upstream reservoir.

CVFPP Goals

Contributes Significantly to: Improve Flood Risk Management

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☑ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained, but requires further evaluation to identify candidate reservoirs where it is feasible to add additional storage by allowing surcharging on spillways.

Advantages:

- Will work well in conjunction with other MAs that increase downstream system capacity and/or strengthen levees.
- Promotes multiple benefits in addition to flood flow reduction (water supply, cold water pool for fisheries management).
- Increased storage provides greater flexibility to adapt to changing climate conditions.
- Low cost.

Disadvantages:

- Dams safety considerations.
- Potential aquatic and terrestrial environmental impacts in reservoir inundation area.
- Potential impact to shoreline recreation facilities in surcharged reservoirs.
- Similar storage volumes in upstream reservoirs are less effective because they affect a smaller portion of the watershed than the downstream reservoir, and because upstream reservoirs are not configured for flood operations and it is not possible to control the rate of filling of the flood pool.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Moderat to low initial investment, depending on location and extent of spillway modifications (cost factors include real estate

acquisitions, relocations, mitigations cost, and complexity of structural modifications to existing dam facilities)

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Little or no change to O&M costs from modifications to existing dam facilities

Potential for Cost-Sharing?

Potential for Federal cost sharing via contributions to existing federal project purposes (flood management and/or water supply).

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Potential to reduce long-term costs for emergency response and recovery through reduction in the frequency or magnitude of flooding.

Flood fighting? (Increase, Decrease, or No Significant Change)

Potential to reduce the frequency (and long-term cost) of flooding

Effect on Damage to Critical Public Infrastructure?

Region specific (cannot determine at this time)

Effect on Floodplain and Economic Development?

No direct effects; however, reduces the frequency of flooding and increases level of flood protection, which may encourage development in the floodplain

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential to reduce State flood responsibility by reducing the frequency of flooding

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

None

Adverse Environmental Impact?

Increasing foothill and upper watershed storage would result in moderate to substantial temporary or permanent impacts (dependent on actions) to terrestrial, wetland, and riparian, including potential loss of habitat for special-status species. Other potential impacts include: change in flow regime (e.g., seasonality, magnitude, and duration of flows), sediment transport, and habitat for aquatic and riparian species.

Permitting Considerations?

Extensive and complex

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Reduces frequency of flooding and improves level of flood protection; no residual risk (as would be associated with similar benefits provided by levees or other downstream features)

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to contribute to water supply, hydropower, and fisheries management

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Providing additional storage in an existing dam through spillway surcharging would generally have a higher likelihood of implementation than constructing new on-stream storage, but institutional and political challenges still exist.

Technical Considerations:

Redirected Hydraulic Impacts?

No redirected downstream impacts; potential hydraulic impacts within reservoir inundation area.

Residual Risk?

Reduces the frequency of flooding, reducing residual risk to existing development.

Climate Change Adaptability:

Increasing use of available upstream storage would enhance hydrologic adaptability by increasing water management flexibility, but could reduce biological adaptibility downstream by reducing the complexity of habitats.

Urban, Small Community, and Non-Urban Considerations:

No specific considerations identified.

Regional Applicability:

Not applicable in Delta Region, but may be used to reduce hydraulic impacts to Delta.

Integration with Other Programs:

References:

USACE 2001 Sacramento and San Joaquin River Basins Comprehensive Study;

DRAFT Management Action Evaluation

Management Action Title: MA-008

Increase flood control allocation by using Spillway Surcharge.

Description:

Problem:

There is insufficient flood management storage available in some existing flood management reservoirs to regulate flood flows. Some of the reservoirs on the Sacramento and San Joaquin rivers have insufficient storage capacity to fully capture average annual unimpaired runoff if no releases are made. From a flood management perspective, maintaining sufficient flood reservation space within reservoirs becomes critical during the rainy season. The deep empty space requirements often drive mandated releases during the flood season to maintain flood storage within the operational flood encroachment curve (Hegedus and Shibatani, 2009). In the San Joaquin Valley, the first part of a flood can fill some reservoirs, and flood operationsare limited by the downstream channel capacities. This increases the likelihood of spilling large flood flows during the latter part of storm events (Independent Review Panel to the California Department of Water

Desired Outcome:

Increase storage in upper watershed reservoirs, upstream from flood management reservoirs.

Methodology:

When storage is available in reservoirs upstream from a flood management reservoir, that storage can often be counted as available flood storage (i.e., French Meadows and Ice House for Folsom Dam and Mammoth Pool for Friant Dam). It may be possible to increase the available storage in existing upper watershed reservoirs by allowing surcharging of the spillways, to increase the storage in the reservoir prior to spills. The use of surcharging is dependent on the design of the dam and spillway, but if it does not reduce the safety of the dam, it could be achieved through the use of temporary or permanent flashboards on top of the spillway of the upstream reservoir.

CVFPP Goals

Contributes Significantly to: Improve Flood Risk Management

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☑ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained, but requires further evaluation to identify candidate reservoirs where it is feasible to add additional storage by allowing surcharging on spillways.

Advantages:

- Will work well in conjunction with other MAs that increase downstream system capacity and/or strengthen levees.
- Promotes multiple benefits in addition to flood flow reduction (water supply, cold water pool for fisheries management).
- Increased storage provides greater flexibility to adapt to changing climate conditions.
- Low cost.

Disadvantages:

- Dams safety considerations.
- Potential aquatic and terrestrial environmental impacts in reservoir inundation area.
- Potential impact to shoreline recreation facilities in surcharged reservoirs.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Moderate to low initial investment, depending on location and extent of spillway modifications (cost factors include real estate acquisitions, relocations, mitigations cost, and complexity of structural modifications to existing dam facilities)

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Little or no change to O&M costs from modifications to existing dam facilities

Potential for Cost-Sharing?

Potential for Federal cost sharing via contributions to existing federal project purposes (flood management and/or water supply).

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Potential to reduce long-term costs for emergency response and recovery through reduction in the frequency or magnitude of flooding.

Flood fighting? (Increase, Decrease, or No Significant Change)

Potential to reduce the frequency (and long-term cost) of flooding

Effect on Damage to Critical Public Infrastructure?

Region specific (cannot determine at this time)

Effect on Floodplain and Economic Development?

No direct effects; however, reduces the frequency of flooding and increases level of flood protection, which may encourage development in the floodplain

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential to reduce State flood responsibility by reducing the frequency of flooding

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

None

Adverse Environmental Impact?

Increasing foothill and upper watershed storage would result in moderate to substantial temporary or permanent impacts (dependent on actions) to terrestrial, wetland, and riparian, including potential loss of habitat for special-status species. Other potential impacts include: change in flow regime (e.g., seasonality, magnitude, and duration of flows), sediment transport, and habitat for aquatic and riparian species.

Permitting Considerations?

Extensive and complex

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Reduces frequency of flooding and improves level of flood protection; no residual risk (as would be associated with similar benefits provided by levees or other downstream features)

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to contribute to water supply, hydropower, recreation, and fisheries management

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Providing additional storage in an existing dam through spillway surcharging would generally have a higher likelihood of

implementation than constructing new on-stream storage, but institutional and political challenges still exist.

Technical Considerations:

Redirected Hydraulic Impacts?

No redirected downstream impacts; potential hydraulic impacts within reservoir inundation area.

Residual Risk?

Reduces the frequency of flooding, reducing residual risk to existing development.

Climate Change Adaptability:

Increasing use of available upstream storage would enhance hydrologic adaptability by increasing water management flexibility, but could reduce biological adaptibility downstream by reducing the complexity of habitats.

Urban, Small Community, and Non-Urban Considerations:

No specific considerations identified.

Regional Applicability:

Not applicable in Delta Region, but may be used to reduce hydraulic impacts to Delta.

Integration with Other Programs:

References:

DRAFT Management Action Evaluation

Management Action Title: MA-009

Increase flood control allocation at existing reservoirs by building new, off-stream storage.

Description:

Problem:

There is insufficient flood management storage available in some existing flood management reservoirs to regulate flood flows. From a flood management perspective, maintaining sufficient flood reservation space within reservoirs becomes critical during the rainy season. The deep empty space requirements often drive mandated releases during the flood season to maintain flood storage within the operational flood encroachment curve (Hegedus and Shibatani, 2009). In the San Joaquin Valley, the first part of a flood can fill some reservoirs, and flood operations are limited by the downstream channel capacities. This increases the likelihood of spilling large flood flows during the latter part of storm events (Independent Review Panel to the California Department of Water Resources, 2007).

Desired Outcome:

Increase available flood management storage allocation in existing reservoirs.

Methodology:

Construct a new off-stream storage reservoir. This reservoir would likely need to be built in relatively close proximity to the existing reservoir so that water could be transferred from the flood management reservoir to the off-stream reservoir. Prior to and during flood season, the availability of storage in the off-stream reservoir could allow water to be diverted from the conservation pool in the flood management reservoir to the off-stream storage reservoir. This would increase the flood management storage in the flood management reservoir while at the same time saving the water diverted from the conservation pool into the off-stream reservoir to be used to replace or augment regular water supply releases later in the year. Storage in the off-stream reservoir would not be creditable or usable as flood management storage, and diversions to the off-stream reservoir would have to occur prior to the beginning of any flood events so that the additional flood storage would be available in the flood management reservoir during flood operations.

CVFPP Goals

Contributes Significantly to: Improve Flood Risk Management

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☑ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained, but requires further evaluation to identify candidate off-stream sites where developing new storage is feasible.

Advantages:

- Will work well in conjunction with other MAs that increase downstream system capacity and/or strengthen levees.
- May promote multiple benefits both as standalone reservoir or in conjuction with existing reservoirs in addition to flood flow reduction (water supply, cold water pool for fisheries management, recreation) if storage is maintained after flood season is over.
- Increased storage provides greater flexibility to adapt to changing climate conditions.

Disadvantages:

- Potentially high capital cost
- Potential terrestrial environmental impacts in reservoir inundation area
- Offstream stoarage potentially less effective than on-stream storage for flood management.

Economic Considerations:

Capital Cost? (High, Medium, Low)

High initial investment, depending on location and size of off-stream reservoir (cost factors include real estate acquisitions, relocations, mitigations cost, and complexity and size of required dam and conveyance facilities)

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

O&M costs from new dam facilities must be considered.

Potential for Cost-Sharing?

Potential for Federal cost sharing via contributions to existing federal project purposes (flood management and/or water supply).

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Potential to reduce long-term costs for emergency response and recovery through reduction in the frequency or magnitude of flooding.

Flood fighting? (Increase, Decrease, or No Significant Change)

Potential to reduce the frequency (and long-term cost) of flooding

Effect on Damage to Critical Public Infrastructure?

Region specific (cannot determine at this time)

Effect on Floodplain and Economic Development?

Direct effects would includeboost to economy during construction of the new reservoir. Indirectly reduces the frequency of flooding and increases level of flood protection, which may encourage new development in the floodplain

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential to reduce State flood responsibility by reducing the frequency of flooding

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

None

Adverse Environmental Impact?

Substantial permanent impacts to terrestrial and potentially wetland habitat, including potential loss of habitat for special-status species; moderate to substantial alteration of physical processes, including flow regime (e.g., seasonality, magnitude, and duration of flows) and sediment transport, that could result in permanent impacts to habitat for aquatic and riparian species.

Permitting Considerations?

Extensive and complex

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Reduces frequency of flooding and improves level of flood protection; no residual risk (as would be associated with similar benefits provided by levees or other downstream features)

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to contribute to water supply, hydropower, recreation, and fisheries management if storage is maintained after flood

season.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Developing new off-stream storage would generally have a higher likelihood of implementation than constructing new on-stream storage, but institutional and political challenges exist.

Technical Considerations:

Redirected Hydraulic Impacts?

No redirected downstream impacts; potential hydraulic impacts within reservoir inundation area.

Residual Risk?

Reduces the frequency of flooding, reducing residual risk to existing development.

Climate Change Adaptability:

This action would enhance hydrologic adaptability by increasing water management flexibility; and it could reduce biological adaptibility by reducing the quantity and connectivity of habitat, which would reduce the ability of species to handle and adjust to the consequences of climate change.

Urban, Small Community, and Non-Urban Considerations:

No specific considerations identified.

Regional Applicability:

Not applicable in Delta Region, but may be used to reduce hydraulic impacts to Delta.

Integration with Other Programs:

References:

USACE 2001 Sacramento and San Joaquin River Basins Comprehensive Study ; Mokelumne/Amador/Calaveras IRWMP - Draft. November, 2006;

DRAFT Management Action Evaluation

Management Action Title: MA-010

Increase flood control allocation at existing reservoirs by expanding existing off-stream storage.

Description:

Problem:

There is insufficient flood management storage available in some existing flood management reservoirs to regulate flood flows. From a flood management perspective, maintaining sufficient flood reservation space within reservoirs becomes critical during the rainy season. The deep empty space requirements often drive mandated releases during the flood season to maintain flood storage within the operational flood encroachment curve (Hegedus and Shibatani, 2009). In the San Joaquin Valley, the first part of a flood can fill some reservoirs, and flood operations are limited by the downstream channel capacities. This increases the likelihood of spilling large flood flows during the latter part of storm events (Independent Review Panel to the California Department of Water Resources, 2007).

Desired Outcome:

Increase available flood management storage allocation in existing reservoirs.

Methodology:

This management action requires an existing off-stream storage reservoir that is available within reasonable proximity of a flood management reservoir. It is likely that the off-stream reservoir would need to be enlarged to provide space for diverted water from the conservation pool of the flood management reservoir. Prior to and during flood season, the availability of storage in the off-stream reservoir would allow water to be diverted from the conservation pool in the flood management reservoir to the off-stream storage reservoir. This would increase the flood management storage in the flood management reservoir while at the same time saving the water diverted from the conservation pool into the off-stream reservoir to be used to replace or augment regular water supply releases later in the year. Storage in the off-stream reservoir would not be creditable or usable as flood management storage, and diversions to the off-stream reservoir would have to occur prior to the beginning of any flood events so that the additional flood storage would be available in the flood management reservoir during flood operations.

CVFPP Goals

Contributes Significantly to: Improve Flood Risk Management

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☑ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained, but requires further evaluation to identify candidate off-stream sites where expanding storage is feasible and the off-stream reservoir is able to work in conjuction with existing flood management reservoir.

Advantages:

- Will work well in conjunction with other MAs that increase downstream system capacity and/or strengthen levees.
- May promote multiple benefits in addition to flood flow reduction (water supply, cold water pool for fisheries management, recreation).
- Increased storage provides greater flexibility to adapt to changing climate conditions.
- Recreation benefits if storage is maintained after flood

Disadvantages:

- Potentially high capital cost.
- Potential terrestrial environmental impacts in reservoir inundation area.
- There is limited existing off-stream storage in the Sacramento and San Joaquin Flood Management System.

season is over.

Economic Considerations:

Capital Cost? (High, Medium, Low)

High initial investment, depending on location and extent of expansion (cost factors include real estate acquisitions, relocations, mitigations cost, and complexity of structural modifications to existing dam facilities).

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Little or no change to O&M costs from modifications to existing off-stream dam facilities

Potential for Cost-Sharing?

Potential for Federal cost sharing via contributions to existing federal project purposes (flood management and/or water supply).

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Potential to reduce long-term costs for emergency response and recovery through reduction in the frequency or magnitude of flooding.

Flood fighting? (Increase, Decrease, or No Significant Change)

Potential to reduce the frequency (and long-term cost) of flooding

Effect on Damage to Critical Public Infrastructure?

Region specific (cannot determine at this time)

Effect on Floodplain and Economic Development?

No direct effects; however, reduces the frequency of flooding and increases level of flood protection, which may encourage development in the floodplain

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential to reduce State flood responsibility by reducing the frequency of flooding

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

None

Adverse Environmental Impact?

Substantial permanent impacts to terrestrial, agricultural, and potentially to seasonal or freshwater marsh wetland habitats, including loss of habitat for special-status species; moderate alteration of physical processes, including flow regime (e.g., seasonality, magnitude, and duration of flows) and sediment transport, that could result in permanent impacts to habitat for aquatic and riparian species.

Permitting Considerations?

Extensive and complex

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Reduces frequency of flooding and improves level of flood protection; no residual risk (as would be associated with similar benefits provided by levees or other downstream features)

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to contribute to water supply, hydropower, recreation, and fisheries management if storage is maintained after flood season.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Expanding existing off-stream storage would generally have a higher likelihood of implementation than constructing new on- or off-stream storage, but institutional and political challenges still exist.

Technical Considerations:

Redirected Hydraulic Impacts?

No redirected downstream impacts; potential hydraulic impacts within reservoir inundation area.

Residual Risk?

Reduces the frequency of flooding, reducing residual risk to existing development.

Climate Change Adaptability:

This action would enhance hydrologic adaptability by increasing water management flexibility; and it could reduce biological adaptibility by reducing the quantity and connectivity of habitat, which would reduce the ability of species to handle and adjust to the consequences of climate change.

Urban, Small Community, and Non-Urban Considerations:

No specific considerations identified.

Regional Applicability:

Not applicable in Delta Region, but may be used to reduce hydraulic impacts to Delta.

Integration with Other Programs:

References:

USACE 2001 Sacramento and San Joaquin River Basins Comprehensive Study;

DRAFT Management Action Evaluation

Management Action Title: MA-011

Establish partnerships to coordinate flood management structure operations.

Description:

Problem:

The operations of flood management facilities are not always coordinated between regions or agencies and do not necessarily serve multiple uses. The Lower San Joaquin River Region is an example in which systemwide coordinated operations are needed to prevent downstream flooding from prescribed releases. Lower San Joaquin River levee and diversion systems are not capable of containing the objective release (maximum control release that can be safely conveyed by downstream channels) from all major, upstream project reservoirs simultaneously due to reductions in channel capacity from sedimentation, debris, and vegetation. Current flood operations can also adversely impact ecosystem function and habitat requirements as mandated by Biological Opinions or other regulations for water quality, downstream temperatures and species migration. Climate change, water supply, conjunctive use and transient storage are also not considered during current operations.

Desired Outcome:

Modify operation and enhance coordination of existing structures to provide better management of floods while serving multiple uses of the system.

Methodology:

Use new and existing partnerships to coordinate flood management structure operations. For example, the Reservoir Coordinated Operations Section and the Hydrology Branch of the Hydrology and Flood Operations Office have embarked on a Forecast Coordinated Operations initiative, in partnership with the USACE, NWS, and individual reservoir operators, to develop the means for interagency coordination of reservoir releases. Ensure all flood relief structures are operated and maintained as designed to preserve systemwide operational integrity. Operations of all facilities should be coordinated to reduce downstream impacts and serve multiple uses within the system. System models could be used to verify results of proposed operations in real time to assist in coordination of operations to achieve these goals.

CVFPP Goals

Contributes Significantly to: Improve Flood Risk Management

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☑ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained, but requires further evaluation to identify candidate off-stream sites where expanding storage is feasible and the off-stream reservoir is able to work in conjuction with existing flood management reservoir.

Advantages:

- Will work well in conjunction with other MAs that increase upstream system capacity and/or strengthen levees
- Low cost
- High value to water supply management.
- High value to ecosystem support if floodplains are used in reoperation scenarios.

Disadvantages:

- May result in water supply, environmental, and recreation impacts.
- Interagency coordination on multiple levels can be difficult and time consuming.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

May increase O&M costs if current O&M is not up to standards. Would also result in potential reduced flood damage costs; potential water supply cost savings.

Potential for Cost-Sharing?

Potential for Federal cost sharing via contributions to existing federal project purposes (flood management and/or water supply). Potential also for local agency or reservoir operator to cost share.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Potential to reduce long-term costs for emergency response and recovery through reduction in the frequency or magnitude of flooding.

Flood fighting? (Increase, Decrease, or No Significant Change)

Potential to reduce the frequency (and long-term cost) of flooding

Effect on Damage to Critical Public Infrastructure?

Effect on Floodplain and Economic Development?

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential to reduce State flood responsibility by reducing the frequency of flooding. Will not reduce frequency of floods in floodplains or bypasses but could reduce likely damaging floods by better flood water management between reservoirs and floodplains/bypasses/detention basins.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

System reoperations can only go so far in benefits if it is limited only to operations of reservoirs. System Reoperations is the key component to developing multibenefit scenarios between flood management and water supply protection and environmental benefits through remanaged floodplains in strategic locations. Floodplain activation frequency is a key ecological function in the CV that can sustain listed fish and wildlife species.

Adverse Environmental Impact?

None

Permitting Considerations?

FERC relicensing considerations for certain faciilities, potentially significant CEQA/NEPA requirements, additional flood easements may require new permitting or authorization

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

Yes new opportunities will be provided to reduce O&M with the new management plans.

Social Considerations:

Public Safety?

Reduces frequency of flooding and improves level of flood protection; no residual risk (as would be associated with similar benefits provided by levees or other downstream features). Also would increase water supply security and public resources protection and enhancement.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to contribute to water supply by reducing need for additional flood management storage. Would create or maintain environmentally functioning open-space or agriculturally beneficial open space.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Institutional and political challenges exist.

Technical Considerations:

Redirected Hydraulic Impacts?

This management action attempts to manage cumulative downstream impacts from flood management facilities and also has hydraulic impacts to conjunctive use opportunities or environmental land or river systems and the Delta.

Residual Risk?

The objective of cooridnated operations would be to reduce the frequency of flooding, reducing residual risk to existing development.

Climate Change Adaptability:

This action could enhance hydrologic adaptability by incorporating climate change scenarios in operations and by increasing flexibility of water management.

Urban, Small Community, and Non-Urban Considerations:

No specific considerations identified.

Regional Applicability:

This is relevant to the entire CV as every main water supply-flood management reservoir will play some role at some time to manage flood water releases or manage for improved water supply conjunctive use options.

Integration with Other Programs:

Need planning coordination with FESSRO conservation strategies as well as DIRWM or Conjunctive use programs. This should consider coordination with outside agency programs as well (ACOE, USBR, USFWS, NOAA, DFG)

References:

DRAFT Management Action Evaluation

Management Action Title: MA-012

Increase flood management flexibility through modifications to the magnitude/timing of flood reservations in reservoirs.

Description:

Problem:

Reservoir operations conducted by many Federal, State and local agencies are largely governed by water control manuals specific to each reservoir. These water control manuals guide operational decisions on the timing and amount of flood space throughout the year and establish objective releases. Operational constraints imposed by manuals can make systemwide, multipurpose coordinated operations and goals difficult to accomplish.

Desired Outcome:

Provide better utilization of existing flood management and conservation storage for flood management.

Methodology:

Work cooperatively with local entities to explore how changes to the flood reserve space can improve flood management flexibility. One example of this is the Sacramento Area Flood Control Agency's (SAFCA) purchase of additional storage space in Folsom reservoir as one means of obtaining more flood space. Modifications to reservoir rule curves could be made to specify additional downstream control points and require the coordination with operations of other reservoirs. System models should not only be used to verify results but model application should be further extended to develop new rules of operation. System models could be used to verify results of proposed operations in real time to assist in coordination.

CVFPP Goals

Contributes Significantly to: Improve Flood Risk Management

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☑ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☑ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained, but requires further evaluation to identify reservoirs where reoperation may be feasible.

Advantages:

- Will work well in conjunction with other MAs that increase upstream system capacity and/or strengthen levees
- Low cost -High value to water supply management High value to ecosystem support if floodplains are used for storage in reoperation scenarios.
- High value to recovery of listed anadromous fishes if passage is a reoperation design criteria

Disadvantages:

- Modification of reservoir operations may affect water supply, hydropower generation (which is a function of storage in the reservoir), environmental flows and temperature, and recreation.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Low initial investment

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Little or no change to O&M costs from reservoir reoperation.

Potential for Cost-Sharing?

Potential for Federal cost sharing via contributions to existing federal project purposes (flood management and/or water supply).

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Potential to reduce long-term costs for emergency response and recovery through reduction in the frequency or magnitude of flooding.

Flood fighting? (Increase, Decrease, or No Significant Change)

Potential to reduce the frequency (and long-term cost) of flooding

Effect on Damage to Critical Public Infrastructure?

Region specific (cannot determine at this time)

Effect on Floodplain and Economic Development?

Better flood protection may encourage floodplain development.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential to reduce State flood responsibility by reducing the frequency of flooding

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

Reservoir reoperations could be beneficial to restoring fluvial geomorphic processes needed by certain species, and thereby also enhance the ecological functions of aquatic and floodplain habitats. Modifying reservoirs to provide fish passage (new system operations) above major dams would provide significant water supply cost reductions and could lead to the recovery of listed fish species that currently restrict water supply, while allowing reservoirs to manage for water supply and floods more effectively.

Adverse Environmental Impact?

None

Permitting Considerations?

Approving modified system rule curves is a major undertaking with ACOE

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Any reoperation that reduces frequency of flooding and improves level of flood protection would have no residual risk (as would be associated with similar benefits provided by levees or other downstream features)

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Possible positive or negative impact to reservoir recreation benefits depending on higher or lower carryover storage following end of flood season. Major benefits to the recovery of anadromous fish species if reservoirs are modified or allowed to pass fish into the upper watersheds. Also would provide water supply benefits by allowing anandromous fish to access historic habitat and reduce water costs below dams.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Modifying reservoir control manuals for flood management reservoirs would be difficult, but would generally have a higher likelihood of implementation than constructing new on- or off-stream storage. However, institutional and political challenges exist.

Technical Considerations:

Redirected Hydraulic Impacts?

Reoperation would likely have redirected downstream impacts, but they would include reduction in stage during flood operations.

Residual Risk?

The objective of reoperation would be to reduce the frequency of flooding, reducing residual risk to existing development.

Climate Change Adaptability:

Modification of operations at flood control reservoirs could enhance hydrologic adaptability by increasing flexibility of water management, particularly if climate change scenarios are incorporated in operations. This action could also enhance biological adaptability by increasing the extent and quality of some aquatic and floodplain habitats, and thus, increase the ability of species to handle and adjust to the consequences of climate change.

Urban, Small Community, and Non-Urban Considerations:

Each of these areas is of some concern to Res ReOps coordination with a purpose of reducing flood risk to as many populated areas as possible. This will concern non-urban areas especially as some of these areas may need to be considered for alternative areas for floodwater transient storage or detention as part of coordinated reoperations.

Regional Applicability:

Applicable in all regions that have flood management reservoirs.

Integration with Other Programs:

Reservoir reoperation studies (HAFOO, future program), Forecast-Coordinated Operations Program (HAFOO) including the Yuba-Feather Forecast-coordinated Operationis Program, Forecast-Based Operations Program

References:

USACE 2001 Sacramento and San Joaquin River Basins Comprehensive Study;Yolo Bypass Management Strategy; Agricultural Stewardship White Paper; RCR; Mokelumne/Amador/Calaveras IRWMP - Draft. November, 2006;

DRAFT Management Action Evaluation

Management Action Title: MA-013

Increase flood management flexibility through modifications to objective release schedules at flood management reservoirs.

Description:

Problem:

Reservoir operations are largely governed by water control manuals specific to each reservoir. These water control manuals guide the timing and amount of flood space throughout the year and establish objective releases (maximum controlled release that can be safely conveyed by downstream channels). Many downstream levee and diversion systems are not capable of containing the objective release of upstream reservoirs.

Desired Outcome:

Provide better utilization of existing flood management and conservation storage for flood management and protection of downstream lands and facilities.

Methodology:

Objective release schedules should be reviewed and revised if needed based on recent data and current watershed conditions. Modifications could provide more flexibility and safety systemwide and decrease the rate and quantity of reservoir encroachment. Decreasing the objective release would have the opposite effect, reducing downstream effects on facilities but also requiring a larger flood management reservation. Releases could be modified to increase the prescribed releases for a given level of forecasted inflow and percent of flood management space used.

CVFPP Goals

Contributes Significantly to: Improve Flood Risk Management

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☑ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained, but requires further evaluation to identify reservoirs where reoperation may be feasible.

Advantages:

- Will work well in conjunction with other MAs that increase upstream system capacity and/or strengthen levees
- Low cost

Disadvantages:

- Modification of reservoir operations may affect water supply

Economic Considerations:

Capital Cost? (High, Medium, Low)

Low initial investment

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Little or no change to O&M costs from reservoir reoperation. Lower objective releases would likely result in lower maintenance costs to repair damage from frequent floods.

Potential for Cost-Sharing?

Potential for federal cost sharing via contributions to existing federal project purposes (flood management and/or water supply).

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Potential to reduce long-term costs for emergency response and recovery through reduction in the frequency or magnitude of flooding.

Flood fighting? (Increase, Decrease, or No Significant Change)

Potential to reduce the frequency (and long-term cost) of flooding

Effect on Damage to Critical Public Infrastructure?

Region specific (cannot determine at this time)

Effect on Floodplain and Economic Development?

No direct effects; however, reduces the frequency of flooding and increases level of flood protection, which may encourage development in the floodplain.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential to reduce State flood responsibility by reducing the frequency of flooding

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

None

Adverse Environmental Impact?

Potential for moderate alteration of physical processes, including flow regime (e.g., seasonality, magnitude, and duration of flows) and sediment transport, that could result in permanent impacts to habitat for aquatic and riparian species.

Permitting Considerations?

Substantial but less complex

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Any reoperation that reduces frequency of flooding and improves level of flood protection would have no residual risk (as would be associated with similar benefits provided by levees or other downstream features)

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to contribute to water supply by reducing need for additional flood management storage. Reservoir recreation benefits if higher carryover storage after flood season is over.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Modifying reservoir control manuals for flood management reservoirs would be difficult, but would generally have a higher likelihood of implementation than constructing new on- or off-stream storage. However, institutional and political challenges exist.

Technical Considerations:

Redirected Hydraulic Impacts?

Reducing objective releases would have redirected downstream impacts, but they would include reduction in stage during flood operations.

Residual Risk?

The objective of modification of objective releases would be to reduce the frequency of flooding, reducing residual risk to

existing development.

Climate Change Adaptability:

Modifying objective release schedules at flood control reservoirs could enhance hydrologic adaptability by increasing water management flexibility.

Urban, Small Community, and Non-Urban Considerations:

No specific considerations identified.

Regional Applicability:

Applicable in all regions that have flood management reservoirs.

Integration with Other Programs:

Reservoir reoperation studies (HAFOO, future program), Forecast-Coordinated Operations Program (HAFOO) including the Yuba-Feather Forecast-coordinated Operationis Program, Forecast-Based Operations Program

References:

USACE 2001 Sacramento and San Joaquin River Basins Comprehensive Study;

DRAFT Management Action Evaluation

Management Action Title: MA-014

Increase flood management flexibility by implementing conjunctive use programs at flood management reservoirs.

Description:

Problem:

Reservoirs and transitory floodplain storage areas help regulate flood flows by attenuating or reducing the magnitude of flood peaks occurring in downstream channels. Currently, there is insufficient flood management storage available in existing flood management reservoirs to regulate flood flows to the extent needed/desired. Maintaining sufficient flood reservation space within reservoirs becomes critical during the rainy season, and maintaining that space results in mandated releases during the flood season (Hegedus and Shibatani, 2009). Conjunctive use projects may be able to use a portion of these mandated releases for groundwater recharge, where feasible. Current climate modeling suggests CA will experience higher peak flows during floods and greater need for water supplies, with possibly more severe droughts. As runoff patterns shift under climate change the ability to capture water after the flood season will diminish. Managing the combination of water supply and flood risk must use new methods to satisfy all the needs.

Desired Outcome:

Reduce flood risk and enhance water supply security by expanding the management tools and methods available.

Methodology:

Adding additional flood management storage allocation in an existing multi-benefit reservoir always results in a conflict with water supply storage allocation. This conflict may be alleviated by pre-storing the water supply allocation in a groundwater bank through conjunctive use operations. Pre-storing will be required because groundwater banks aren't able to take water in sufficient quantity to be used during flood operations. With the water stored in a groundwater bank, shortfalls that might result from the increase in flood management storage allocation could be replaced with water withdrawn from the groundwater bank.

CVFPP Goals

Contributes Significantly to: Improve Flood Risk Management

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☑ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained, but requires further evaluation to identify reservoirs where conjunctive use operations may be feasible.

Advantages:

- Would have other benefits such as water supply. This would be a way of providing more storage without building a new reservoir or enlarging a new dam.

Disadvantages:

- Some water may be lost permanently after recharge and, while creating more flood storage space, may not be recoverable for water supplies.
- Land may not be readily available for recharge.
- Surface storage has recreation benefits; redirecting storage to groundwater will diminish recreation benefits.
- Coordination between agencies and implementing land use changes would be challenging.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Moderate initial investment, depending on location and extent of facilities required to conduct conjunctive use operations (cost factors include real estate acquisition, conveyance and pumping facilities, and environmental mitigation costs). Costs would be distributed across multiple sources but primarily come from water supply and flood management funds. If range land restoration becomes a key component, long term restoration costs could be significant due to the large amount of range land, but unit costs for water and flood protection would be relatively low.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

O&M costs would likely increase significantly resulting from O&M for conjunctive use facilities, especially the pumping costs associated with accessing water supplies stored in groundwater banks.

Potential for Cost-Sharing?

Potential for Federal cost sharing via contributions to existing federal project purposes (flood management and/or water supply). Also as multiple benefits are incorporated costs can be distributed across multiple programs and fund sources, so that coordinated cost sharing becomes the norm. If this measure happens it is not just a Corps flood project, but a true multi-benefit project.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Potential to reduce long-term costs for emergency response and recovery, and water supply shortages, through reduction in the frequency or magnitude of flooding.

Flood fighting? (Increase, Decrease, or No Significant Change)

Potential to reduce the frequency (and long-term cost) of flooding. Also, potentially restructures the runoff event, changing the potential for high risk floods.

Effect on Damage to Critical Public Infrastructure?

Region specific (cannot determine at this time)

Effect on Floodplain and Economic Development?

No direct effects; however, reduces the frequency of flooding and increases level of flood protection, which may encourage development in the floodplain. Some recharge areas may be sited on floodplains, so that these areas would be restricted in their development potential. The increase in water supply reliability should improve economic development, or at least make it more stable.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential to reduce State flood responsibility by reducing the frequency of flooding

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

N/A

Adverse Environmental Impact?

If new artificial recharge facilities are constructed in floodplains or agricultural lands, this action could result in moderate to substantial permanent impacts to terrestrial, agricultural, and potentially seasonal wetland habitats, including potential loss of habitat for special-status species. Changing a land use of any type has impacts.

Permitting Considerations?

Extensive and complex

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

Tempering peak flows has substantial O&M potential and to the extent that water supply capture can temper peak flows we have flood management cost savings.

Social Considerations:

Public Safety?

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to provide water supply benefits, given the ability to store excess flood waters, and then access them during dry periods.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Providing additional storage through conjunctive use would generally have a higher likelihood of implementation than constructing new on-stream storage, but institutional and political challenges exist.

Technical Considerations:

Redirected Hydraulic Impacts?

No redirected downstream impacts; potential hydraulic impacts within transitory storage inundation area.

Residual Risk?

Climate Change Adaptability:

Urban, Small Community, and Non-Urban Considerations:

xisting or new conjunctive use facilities may need to be sited in non-urban areas such as agricultural areas. There could also be opposition in areas where new facilities are placed.

Regional Applicability:

Applicable in all regions that have flood management reservoirs and available land and suitable geology for conjunctive use.

Integration with Other Programs:

A large number of opportunities for integrating with other needs.

References:

Mokelumne/Amador/Calaveras IRWMP - Draft. November, 2006; USACE 2001 Sacramento and San Joaquin River Basins Comprehensive Study;Environmental Sustainability Summary; RCR; Boyle & Associates, 2008. Madera County Integrated Regional Water Management Plan;

DRAFT Management Action Evaluation

Management Action Title: MA-015

Increase flood management flexibility by using transitory storage.

Description:

Problem:

Reservoir operations are largely governed by water control manuals specific to each reservoir. These water control manuals guide the timing and amount of water release throughout the year. The current rule curves were developed based on the expected amount of historic flood flows and may not always allow the operational flexibility to allow for multiple uses, while conserving necessary space for flood waters. Climate change may affect future storm intensities and operations may need to be modified to accommodate the changing conditions. Additional storage space, such as transitory storage, should be evaluated to relieve some of the burden placed on system reservoirs by competing uses and needs.

Desired Outcome:

Increase available flood management storage and operational flexibility within the system by reoperating reservoirs in conjunction with downstream transitory storage areas.

Methodology:

Transitory storage occurs when peak flows are stored off-stream in adjacent areas until streamflows decrease and the water stored in transitory storage areas can flow back into the stream. Transitory storage can be natural, such as flows overtopping a bank and flowing into a wetland, or can be engineered using weirs and bypasses to direct flows onto lands or bypasses adjacent to the river. Transitory storage can attenuate flooding both locally and downstream and also would facilitate use of the flood system for multiple benefits, such as habitat or conjunctive use. Reoperation of a single flood management reservoir to take advantage of transitory storage would depend on the location of the transitory storage relative to the reservoir. If the transitory storage is a short distance downstream from the reservoir, then it may be possible to manage operations at the reservoir to optimize the effectiveness of the transitory storage. This ability is significantly reduced as the distance between the reservoir and the transitory storage increases due to travel time and additional inflows but could still be very useful if operation of reservoirs and transient storage is coordinated on a systemwide basis.

CVFPP Goals

Contributes Significantly to: Improve Flood Risk Management

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☑ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☑ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained, but requires further evaluation to identify reservoirs where operations to coordinate with transitory storage may be feasible.

Advantages:

- Takes advantage of natural areas.
- Alleviates burden on reservoirs and the need to build additional storage.
- Low cost
- Reestablishes regionally significant habitat in seasonal historic floodways, lowered flood risk to urban areas, and improved ability to manage larger flood events with lowered damages and less costly, quicker recovery over the long-term.

Disadvantages:

- Modification of reservoir operation to allow holding more flood water in conjunction with allowing transitory floodwater storage on floodplains can reduce potential impacts to water supply and even allow for potential improved conjunctive groundwater management.
- Impact maybe to lands that would have longer periods of flooding than current potentially.
- Transitory storage area may have an ecological impact.

• Also increases potential for recovery of listed anadromous fishes which would also reduce water supply restrictions currently faced by the State at Delta pump facilities.	Remediation may be required.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Low to moderate initial investment, depending on location and extent of required construction to develop new transitory storage (cost factors include real estate acquisitions, relocations, mitigations cost, and complexity of new facilities)

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Little or no change to O&M costs from modifications to existing dam facilities

Potential for Cost-Sharing?

Potential for Federal cost sharing via contributions to existing federal project purposes (flood management and/or water supply). - Good to great potential for federal cost share for dam modifications or new bypass/floodplain acquisitions for ecosystem benefits and certainly cost share available if new floodplains are recreated due to setback levees for system improvements.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Potential to reduce long-term costs for emergency response and recovery through reduction in the frequency or magnitude of flooding. - Reduced with new floodplains, new dam facilities for flood release management options that could result in better flood management in the CV. Lower potential for catastrophic damages to water supply systems, urban or urbanizing areas, less damage to some ag areas (potential for easier/quicker recovery), lessen environmental damage and create opportunities for quicker recovery.

Flood fighting? (Increase, Decrease, or No Significant Change)

Potential to reduce the frequency (and long-term cost) of flooding

Effect on Damage to Critical Public Infrastructure?

Region specific (cannot determine at this time)

Effect on Floodplain and Economic Development?

May impact some floodplain development potential if in areas designated for transitory storage, but would also reduce flood risk to State overall.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential to reduce State flood responsibility by reducing the frequency of flooding

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

Could rehabilitate physical processes and ecological functions if transitory storage is in historical floodplains and flood basins, including enhancing floodplain forming processes, and salmonid rearing and Sacramento splittail spawning habitat. - Physical and ecological functions have the potential to increase (or decrease too- ie. stranding splittail, fishes) depending upon timing and frequency of inundation, conditions, etc.

Adverse Environmental Impact?

If transitory floodplain storage is located in areas that are not active or historical fllodplains or floodbasins, this action could result in moderate to substantial permanent impacts to terrestrial, agricultural, and potentially seasonal wetland habitats, including potential loss of habitat for special-status species. Flooding for seasonal wetlands is what is needed to sustain these ecosystems and how they function as natural flood detention areas.

Permitting Considerations?

Extensive and complex

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

With new transitory storage and/or floodplains or wetlands then the habitat benefits can possibly be offsetting for future O&M needs. Any new detention or seasonally flooded lands that also have native habitats allowed will could ultimately reduce the mitigation burdens for O&M on levees or in some cases in bypasses. This would be worked out in the system planning and permit process.

Social Considerations:

Public Safety?

Reduces frequency of flooding and improves level of flood protection; no residual risk (as would be associated with similar benefits provided by levees or other downstream features)

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to contribute to habitat restoration through wetting of floodplains in transitory storage areas. Many potential environmental and public open space benefits as long as access is permissible.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

High likelihood if looking for best use of funds for most multiple benefits to public safety, water supply reliability and significant endangered species and ecosystem function recovery. But most of all in consideration of the best management options for overall adaptation strategies for managing future climate change potential impacts to the State.

Technical Considerations:

Redirected Hydraulic Impacts?

Reoperation would likely have redirected impacts downstream INCLUDING OVERALL reduction in THE CHANNEL stage.

Residual Risk?

Reduces the frequency of flooding, reducing residual risk to existing development.

Climate Change Adaptability:

Reoperation in coordination with transitory floodplain storage would enhance hydrologic adaptability by increasing water management flexibility, and could enahnce biological adaptability if transitory storage is in historical floodplains and floodbasins (because in those locations it could increase the ability of aquatic and floodplain species to handle and adjust to the consequences of climate change).

Urban, Small Community, and Non-Urban Considerations:

Existing or new transitory storage facilities will need to be sited in non-urban areas such as wildlife refuges or agricultural areas.

Regional Applicability:

Not applicable in Delta Region, but may be used to reduce hydraulic impacts to Delta. Seasonal transitory flood areas would also contribute to national and international commerce through the use and benefits to migratory waterfowl and the industries around these resources.

Integration with Other Programs:

Flood Corridors Program (Projects Office). DIRWM regional water management grant applicants that are developing regional water supply and flood integration and habitat plans

References:

DRAFT Management Action Evaluation

Management Action Title: MA-016

Improve conveyance and facilitate habitat restoration by reducing flow constrictions.

Description:

Problem:

Bridges, marinas, in-channel structures, sedimentation, and hard points can affect the hydraulics of channels and bypasses by constricting and slowing flood flows. They can also trap large debris during flood events, which can create significant backwater effects and further reduce flood flow capacity.

Desired Outcome:

Increase channel or bypass flood conveyance capacity by reducing impedance to flood flow, where feasible.

Methodology:

Removal, modification, or relocation of flow constrictions and hardpoints can increase overall channel capacity and/or reduce flooding upstream. Specific actions or treatments would depend on the type of flow constriction or hard point. For example, existing bridges that impede flood flows could be removed, replaced, or modified/raised to improve conveyance; new bridges within designated floodways could be constructed to standards that prohibit constraints on conveyance capacity and reduce backwater effects. Dredging and sediment removal could be used to reduce other types of flow constrictions. Marinas or other flow impediments could be modified or relocated to prevent accumulation of debris during floods. Changing the physical features of the conveyance system to reduce flow constrictions could also provide opportunities to restore ecosystem functions or habitats. For example, removing rock revetment, dikes, or other structures in the channel in conjunction with setback levee construction could promote natural erosion and deposition processes and provide opportunities for riparian habitat restoration; wetland, shallow water, or terrestrial habitats could also be established in conjunction with projects to reduce flow constrictions and improve flood flow capacity.

CVFPP Goals

Contributes Significantly to: Improve Flood Risk Management

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☑ Improve Operation and Maintenance
- ☑ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☐ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained; requires further evaluation to identify flow constrictions and specific actions to address them

Advantages:

- Increases channel capacity and reduces flood risk.
- Works well in conjunction with other actions that increase system capacity and/or reliability
- Potential to combine with other actions to improve ecosystem functions, habitat.
- Potential to reduce O&M costs associated with debris removal or erosion repairs

Disadvantages:

- Potentially high capital cost.
- For bridge modifications, potential for traffic distruption.
- Channel modification (such as dredging), potential for water quality or other aquatic impacts.
- Permitting and mitigation may be costly, extensive and lengthy.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Potentially high initial investment depending on number and type of flow constrictions to be removed, replaced, or modified; bridge modifications or replacements could be costly Permitting and mitigation costs could also be high Potentially high cost

for levee realignment

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

May reduce O&M costs associated with debris removal and erosion repairs after floods However, O&M costs may increase if sediment removal is completed on a regular basis O&M costs may increase to protect embankments and repair other damage to structures that can be eroded as a result of changes in the flow regime

Potential for Cost-Sharing?

Potential for Federal cost sharing via contributions to existing Federal project purposes (flood management) Potential also exists for system-wide cost sharing between locals, depending on the range of effects from the action For example, funds to replace functional or structurally deficient bridges can come from highway bridge replacement and rehabilitation program

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Potential to reduce long-term costs for emergency response and recovery through reduction in the frequency or magnitude of flooding due to increased channel conveyance capacity

Flood fighting? (Increase, Decrease, or No Significant Change)

Potential to reduce the long-term cost of floodfighting through reduction in the frequency or magnitude of flooding and reduction in debris removal actions during floods

Effect on Damage to Critical Public Infrastructure?

Potential to reduce damage to critical public infrastructure through reduction in the frequency or magnitude of flooding due to increased channel capacity Potoential improvement to infrastructure

Effect on Floodplain and Economic Development?

No direct effects; however, reduces the frequency of flooding and increases level of flood protection, which may encourage development in floodplain areas receiving benefits

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential to reduce State liability through reduction in the frequency or magnitude of flooding due to increased channel capacity

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

Reducing flow constrictions and hard points could also contribute to rehabilitating physical processes, including sediment transport and channel forming processes, and could improve aquatic and riparian habitat (particularly if incorporated into design and implementation)

Adverse Environmental Impact?

Reducing flow constrictions and removing hard points would result in minor to moderate temporary impacts during construction (and potentially permanent impacts) to aquatic and riparian habitats and associated species, particularly if habitat is not incorporated into design and implementation

Permitting Considerations?

High for most types of flow constrictions

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

By reducing constrictions, there is the potential to reduce the need for O&M, and therefore reduce the negative environmental impacts asociated with O&M operations (assuming these improvements are designed so they do not increase erosion) O&M could be done at regular intervals, and could possibly be scheduled for times when the environmental impacts are minimal

Social Considerations:

Public Safety?

Potential to increase public safety through reduction in the frequency or magnitude of flooding due to increased channel capacity; no residual risk

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

None

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Dependent on site/location and type of flow constriction; for bridges, likelihood of imlementation would depend typen (vehicle versus rail), capacity, deisgn, and other factors For marinas, in-channel structures, sedimentation, and hard points other implementation factors may include ownership, ability to relocate, and other jurisdictional issues

Technical Considerations:

Redirected Hydraulic Impacts?

Increasing channel capacity can potentially increase downstream flood flows and stages and potentially affect sediment deposition and/or erosion

Residual Risk?

No change in residual risk

Climate Change Adaptability:

No direct effects

Urban, Small Community, and Non-Urban Considerations:

Location specific (cannot determine at this time)

Regional Applicability:

Applicable in all regions where hard points and constrictions exist However, further evaluation may be needed; cost-to-benefit ratio may preclude applicability

Integration with Other Programs:

Channel maintenance technical evaluations including hydraulic models and conveyance analysis (FMO), Evaluation of Hydraulic Carrying Capacity of Channels (HAFOO), Bridge Inspection Program (FMO)

References:

Environmental Sustainability Summary; Boyle & Associates, 2008. Madera County Integrated Regional Water Management Plan; RCR; Colusa Basin IRWMP;

DRAFT Management Action Evaluation

Management Action Title: MA-017

Increase capacity of existing bypasses.

Description:

Problem:

Some bypasses have insufficient capacity to convey flood flows, or cannot convey intended design capacities due to changed channel conditions.

Desired Outcome:

Increase or restore the flood conveyance capacity of existing bypasses.

Methodology:

This measure could include widening or expanding the footprint of existing bypasses, or raising levees or berms along existing bypasses to create more flood carrying capacity. It may also require the reconstruction and/or re-operation of existing flow control weirs that direct flood flows into bypasses. This measure could also include sediment removal or vegetation control. Increasing the capacity of certain bypasses could provide opportunities for habitat, recreation, and agricultural enhancement; these functions would be integrated into the evaluation of specific actions.

CVFPP Goals

Contributes Significantly to: Improve Flood Risk Management

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☑ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☐ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained; requires further evaluation to determine how existing bypasses could be modified to increase flood flow capacity

Advantages:

- Increases channel capacity and reduces flood risk.
- Potential to combine with other actions to improve or restore habitat

Disadvantages:

- Moderate to high capital cost to widen bypasses, raise bypass levees, or reconstruct/modify weirs.
- Permitting and associated mitigation as well as additional vegetation maintenance could be costly and time consuming.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Moderate to high capital cost to implement reoperation of weir changes, widen bypasses, raise bypass levees, or reconstruct weirs

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Potential to increase O&M costs for vegetation control and management Potential to decrease O&M costs if modifications are constructed to new design standards; less maintenance may be required

Potential for Cost-Sharing?

Potential for Federal cost sharing via contributions to existing Federal project purposes (flood management)

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Potential to reduce long-term costs for emergency response and recovery through reduction in the frequency or magnitude of

flooding due to increased flood conveyance capacity

Flood fighting? (Increase, Decrease, or No Significant Change)

Potential to reduce the long-term cost of floodfighting through reduction in the frequency or magnitude of flooding due to increased flood conveyance capacity

Effect on Damage to Critical Public Infrastructure?

Potential to reduce damage to critical public infrastructure through reduction in the frequency or magnitude of flooding due to increased flood conveyance capacity

Effect on Floodplain and Economic Development?

No direct effects; however, reduces the frequency of flooding and increases level of flood protection, which may encourage development in floodplain areas receiving benefits

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential to reduce State liability through reduction in the frequency or magnitude of flooding due to increased flood convneyance capacity

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

In combination with other actions, increasing the capacity of existing bypasses could enhance key physical processes and ecological functions by restoring more natural flow regime to bypasses within historic overflow areas (potential to restore channel and floodplain forming processes and improve salmonid rearing)

Adverse Environmental Impact?

Increasing the capacity of existing bypasses by widening could result in substantial permanent impacts including loss of upland habitat and effects on associated species

Permitting Considerations?

Extensive, complex, and potentially costly

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Potential to increase public safety through reduction in the frequency or magnitude of flooding due to increased flood conveyance capacity; no change in residual risk

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

None

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Bypass modification likely to be more feasible/implementable than construction of new bypasses

Technical Considerations:

Redirected Hydraulic Impacts?

Increasing bypass capacity can potentially increase downstream flood flows and stages

Residual Risk?

No change in residual risk

Climate Change Adaptability:

Increasing the capacity of existing bypasses could enhance hydrologic adaptability by increasing water management flexibility; could potentially enhance biological adaptability by increasing the quantity of aquatic and riparian habitats and thus the ability of associated species to adjust to changing climate conditions

Urban, Small Community, and Non-Urban Considerations:

Location specific (cannot determine at this time)

Regional Applicability:

Applicable in all regions where bypasses exist

Integration with Other Programs:

Channel maintenance technical evaluations including hydraulic models and conveyance analysis (FMO, FPO), Hydraulic Structures Inspection and Rehabilitation Program (FMO), Evaluation of Hydraulic Carrying Capacity of Channels (HAFOO)

References:

USACE 2001 Sacramento and San Joaquin River Basins Comprehensive Study;RCR; Delta Risk Management Strategy;

DRAFT Management Action Evaluation

Management Action Title: MA-018

Modify existing weirs or overflows to improve flood system performance.

Description:

Problem:

The outdated design of current flood relief structures, while providing flood control, also create areas of debris and sediment accumulation. The performance and operation of weirs and flood overflows can be negatively affected by factors such as accumulation of sediment or debris, downstream flow restrictions, antiquated control systems, subsidence, erosion, structural deficiencies, and functional obsolescence.

Desired Outcome:

Improve flood system operations by modifying existing weirs and overflows.

Methodology:

Aspects of the flood management system are controlled or operated via weirs (both with and without gates) and overflows (such as lowered segments of levees designed to permit overflows at certain stages) to divert flood flows to the bypasses and for irrigation during non-flood season. Weirs could be modified in several ways (raised, lowered, lengthened, or automated) depending upon the operation and desired effect. For example, a weir crest could be raised to prevent flows from entering a storage area too early in a flood event, thereby reserving storage space for the storm peak. Alternately, weirs could be lengthened to pass more flow into a bypass at the same stage, or lowered to divert flow at lower stages. Other modifications could include removal of sediment or debris to improve the intended performance of the weir. Weir modifications could also be designed to provide opportunities to restore ecosystem functions or habitats, reduce O&M, and improve safety. For example, improvements to weirs could allow greater fish passage, change the flow split, manage sediment deposition, or increase the safety of weir operations (floodgates).

CVFPP Goals

Contributes Significantly to: Improve Flood Risk Management

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☑ Improve Operation and Maintenance
- ☑ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☐ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained; requires further evaluation

Advantages:

- Potential to increase flood conveyance capacity and reduce flood risk.
- Potential to increase safety of flood management operations.

Disadvantages:

- Moderate to high capital cost to raise, lower, lengthen, reoperate, or automate some weirs.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Moderate to high capital cost to raise, lower, lengthen, or automate weirs depending on the type, operation, and desired effect

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Potential to reduce O&M costs if weir operations are automated or modified to reduce sediment/debris removal requirements

Potential for Cost-Sharing?

Potential for Federal cost sharing via contributions to existing Federal project purposes (flood management)

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Potential to reduce long-term costs for emergency response and recovery through reduction in the frequency or magnitude of flooding

Flood fighting? (Increase, Decrease, or No Significant Change)

Potential to reduce the long-term cost of floodfighting through reduction in the frequency or magnitude of flooding

Effect on Damage to Critical Public Infrastructure?

Potential to reduce damage to critical public infrastructure through reduction in the frequency or magnitude of flooding

Effect on Floodplain and Economic Development?

No direct effects; however, reduces the frequency of flooding and increases level of flood protection, which may encourage development in floodplain areas receiving benefits

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential to reduce State liability through reduction in the frequency or magnitude of flooding if weir modifications increase channel capacity.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

Weirs could be modified to facilitate operations that enhance key physical processes and ecological functions (restoring more natural flow regimes, for example); depending on implementation, operational changes could benefit channel and floodplain forming processes and salmonid rearing

Adverse Environmental Impact?

Depending on implementation, the modification of weirs could moderatley alter physical processes downstream, including flow regime (e.g., seasonality, magnitude, and duration of flows) and sediment transport, that could result in permanent impacts (either beneficial or detrimental) to habitat for aquatic and riparian species

Permitting Considerations?

Substantial

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Potential to increase public safety through reduction in the frequency or magnitude of flooding

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

None

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Reoperation of some weirs my provide some benefits with little cost

Technical Considerations:

Redirected Hydraulic Impacts?

Weir modification and reoperation could increase flows to the bypasses; these impacts would need to be mitigated if downstream channel capacities could not accommodate increased flows

Residual Risk?

No change in residual risk

Climate Change Adaptability:

Modifying weirs could enhance hydrologic adaptability by increasing water management flexibility

Urban, Small Community, and Non-Urban Considerations:

Location specific (cannot determine at this time)

Regional Applicability:

Applicable for weirs and overflow structures that are essential to the operation and maintenance of the flood control system

Integration with Other Programs:

Hydraulic Structures Inspection Program (FMO), Channel Evaluation Program (FMO)

References:

USACE 2001 Sacramento and San Joaquin River Basins Comprehensive Study;

DRAFT Management Action Evaluation

Management Action Title: MA-019

Construct new bypasses to improve flood system performance.

Description:

Problem:

Some reaches of the flood management system have insufficient flow capacity.

Desired Outcome:

To provide relief to the areas of the flood conveyance system that do not have the capacity to provide the required level of flood protection by constructing new bypasses to add capacity.

Methodology:

New bypasses could be constructed to work with existing flood management channels and facilities, redirecting flood flows away from protected areas or reaches with insufficient flow capacity and carrying high frequency flow events. Specific actions would take into consideration various factors, including: the topography of the proposed bypass location, the magnitude of flow that would be redirected, hydraulic impacts to areas downstream from the proposed bypass, opportunities for habitat, recreation, and agricultural enhancement, and real estate requirements along the bypass route.

CVFPP Goals

Contributes Significantly to: Improve Flood Risk Management

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☑ Improve Operation and Maintenance
- ☑ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☑ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained; requires further evaluation

Advantages:

- Increases channel capacity and reduces flood risk.
- Potential to integrate ecosystem restoration/habitat.
- Potential to provide or maintain other benefits (agriculture, recreation, groundwater recharge).

Disadvantages:

- High capital cost to construct new bypasses and aquire real estate; choosing the best locations may be difficult due to existing development.
- Potential medium to high costs for environmental obligations (including mitigation) and long-term O &M and/or vegetation management.

Economic Considerations:

Capital Cost? (High, Medium, Low)

High initial investment depending on location and extent of the bypasses (costs inclue real estate acquisitions, mitigation costs, and bypass construction costs).

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

New O&M costs would be associated with the construction of new bypasses

Potential for Cost-Sharing?

Potential for Federal cost sharing via contributions to existing Federal project purposes (flood management)

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Potential to reduce long-term costs for emergency response and recovery through reduction in the frequency or magnitude of flooding

Flood fighting? (Increase, Decrease, or No Significant Change)

Potential to reduce the long-term cost of floodfighting through reduction in the frequency or magnitude of flooding and diversion of high flows from reaches with insufficient channel capacitiy or deficient levees However, the addition of a new bypass adds a structure to the facilities that must now be patrolled/monitored and could possibly fail in a flood situation

Effect on Damage to Critical Public Infrastructure?

Potential to reduce damage to critical public infrastructure through reduction in the frequency or magnitude of flooding

Effect on Floodplain and Economic Development?

No direct effects; however, reduces the frequency of flooding and increases level of flood protection, which may encourage development in floodplain areas receiving benefits

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential to reduce State liability through reduction in the frequency or magnitude of flooding due to increased channel capacity

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

New bypasses could be designed to enhance key physical processes and ecological functions (restoring flood flows to historic flood basins or overflow areas, rehabilitating floodplain forming processes, and riparian and seasonal wetland habitat development)

Adverse Environmental Impact?

Constructing new bypasses would result in moderate to substantial permanent impacts to terrestrial and agricultural habitats, including potential loss of habitat for associated special-status species; potential for minor to moderate alteration of physical processes downstream, including flow regime (e.g., seasonality, magnitude, and duration of flows) and sediment transport, that could result in permanent impacts to habitat for aquatic and riparian species

Permitting Considerations?

Extensive and complex

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

Creation of new habitat for floodplain-dependent species could reduce the adverse impacts of the flood management system by restoring part of the system

Social Considerations:

Public Safety?

Potential to increase public safety through reduction in the frequency or magnitude of flooding

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential for ecosystem restoration, recreation, and agriculture to be integrated to maximize overall project benefits

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Feasibility would be highly dependent on location (real estate requirements, land uses or infrastructure affected), cost, and magnitude of benefits provided; new bypasses that provide mutliple benefits would have a higher likelihood of acceptability and implementation

Technical Considerations:

Redirected Hydraulic Impacts?

Bypasses could increase flows to downstream reaches; these impacts would need to be mitigated if downstream channel

capacities could not accommodate increased flows Modulation of the flow should be a major design consideration so that the volume or flow downstream of the confluence is less than that would have occur without the bypass

Residual Risk?

No change in residual risk

Climate Change Adaptability:

Constructing new bypasses could enhance hydrologic adaptability by increasing water management flexibility; could also enhance biological adaptabiity by increasing habitat quantity, connectivity, and complexity, thus enhancing the ability of populations to adjust to the consequences of climate change

Urban, Small Community, and Non-Urban Considerations:

Location specific (cannot determine at this time)

Regional Applicability:

Applicable in regions where additional channel capacity is needed and locations for new bypasses exist; new bypasses are not applicable within Delta region

Integration with Other Programs:

Integrated Regional Water Management Program, State Water Project, Central Water Project

References:

USACE 2001 Sacramento and San Joaquin River Basins Comprehensive Study;RCR; Delta Risk Management Strategy; Colusa Basin IRWMP;Integrated Regional Water Plan

DRAFT Management Action Evaluation

Management Action Title: MA-020

Construct new levees to expand existing system capability.

Description:

Problem:

Insufficient flow capacity in some non-leveed reaches of the flood management system due to changes in the channel hydraulics, landuse patterns, and environmental conditions.

Desired Outcome:

Increase system capacity by constructing new levees.

Methodology:

New levees could be constructed along river reaches where no levees are currently present to increase the carrying capacity of the existing river channel and modulate peak flows. By modifying the flow regime, new levees constructed upstream of urban areas may be an effective measure in lowering the risk of flooding. Levee construction may not be feasible in all urban areas due to high cost of land acquisition. However, in some urban areas, there may be no other measures capable of managing floodflows.

CVFPP Goals

Contributes Significantly to: Improve Flood Risk Management

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☐ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retain for further evaluation; look for opportunity.

Advantages:

- Reduces the chances of inundation.

Disadvantages:

- Potentially high capital cost.
- May result in downstream hydraulic impacts due to increased channel capacity.
- Potential for long permitting process, legal issues due to land acquisition, and high mitigation costs from environmental impacts

Economic Considerations:

Capital Cost? (High, Medium, Low)

High capital costs, dependant on location and amount of new levee construction. Costs include construction, permitting, mitigation, real estate acquisitions, and relocations.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Increased O&M costs proportional to amount of new levee construction.

Potential for Cost-Sharing?

Opportunities to partner with USACE and locals

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Likely reduction in long-term costs for emergency response and recovery through reduction in frequency of flooding.

Flood fighting? (Increase, Decrease, or No Significant Change)

Likely reduction in floodfighting costs through reduction in frequency of flooding.

Effect on Damage to Critical Public Infrastructure?

Reducing the risk of flooding reduces the likelihood of damage to critical public infrastructure.

Effect on Floodplain and Economic Development?

Reduces the frequency of flooding and increases level of flood protection, which may encourage development in the floodplain

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential to expand State flood responsibility by increasing the project-levee system.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

None

Adverse Environmental Impact?

Substantial permanent impacts to terrestrial, riparian and shaded riverine aquatic habitats including loss of habitat for special-status species, and may cut-off species by inhibiting access to habitat areas. Substantial alteration of physical processes, including flow regime (e.g., seasonality, magnitude, and duration of flows) and sediment transport, that could result in permanent impacts to habitat for aquatic and riparian species.

Permitting Considerations?

Extensive and complex

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Improves level of flood protection by reducing the frequency of flooding; residual risk remains and may increase if floodplain development increases.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

No other benefits identified

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Improving the level of flood protection is politically desirable, particularly in urban and urbanizing areas. However, high capital costs and environmental impacts may present a challenge to widespread implementation.

Technical Considerations:

Redirected Hydraulic Impacts?

If the new levees increase the carrying capacity of the channel and constrict additional flows in the channel, downstream impacts may result, particularly in downstream areas with lower levels of flood protection. However, if new levees are used to modulate flow peaks, reduced impacts may be experienced downstream.

Residual Risk?

Reduces the frequency of flooding. May increase residual risk if floodplain development is encouraged.

Climate Change Adaptability:

Constructing new levees would enhance hydrologic adaptability by increasing system capacity. However, this action would

reduce biological adaptability by reducing quantity and complexity of floodplain habitats, and the continuity of these habitats along environmental gradients; and thus, reducing the ability of species to handle and adjust to the consequences of climate change.ability to maintain floodplain species and habitats under more extreme conditions

Urban, Small Community, and Non-Urban Considerations:

Construction of new levees may be benefit small comunities. Construction of new levees in urban areas depend on land availability and feasibility of other flood protection measures.

Regional Applicability:

Dependent upon site factors, land availability, and financing.

Integration with Other Programs:

Flood Projects Office; transportation corridors;

References:

USACE 2001 Sacramento and San Joaquin River Basins Comprehensive Study;

DRAFT Management Action Evaluation

Management Action Title: MA-021

Raise levees to improve flood system performance.

Description:

Problem:

There are several reaches along the flood control levees with insufficient freeboard (less than 3 ft along rivers and less than 6 feet along bypasses). The freeboard is referenced to either a 100-year flood or the 1955/1957 water surface profile. With current hydraulic analyses being performed to estimate water surface elevation for a 200-year flood, it is likely that additional reaches will have insufficient freeboard.

Desired Outcome:

Provide an adequate level of freeboard and increase the conveyance capacity of the channel adjacent to the levee by raising levees.

Methodology:

Raising levees could allow larger design flows, or larger project flows, to pass with adequate freeboard. Specific actions would take into consideration various factors, including: the need to perform a geotechnical evaluation of the structural integrity of the levee for stability and seepage; land use and corresponding level of safety needs on either side of the levee which may be different; and modification of some privately owned levees, which provide significant benefits or are essential to management of the system, which would require adoption of these structures by either the Central Valley Flood Protection Board or Corps.

CVFPP Goals

Contributes Significantly to: Improve Flood Risk Management

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☐ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retain for further evaluation; look for opportunity.

Advantages:

- Reduces the chances of levee overtopping.

Disadvantages:

- Potentially high capital cost due enlargement of levee footprint.
- May result in downstream hydraulic impacts due to increased channel capacity.
- Raising levees and formal adoption as a federal project levee could transfer maintenance responsibility to DWR, thus increasing maintenance costs and time.

Economic Considerations:

Capital Cost? (High, Medium, Low)

High capital cost because raising levee will likely require acquiring additional real estate. Small levee raise (less than 2 feet) could be perform with flood walls, in which case the capital cost is relatively low.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Minimum or no significant increase in annual maintenance costs.

Potential for Cost-Sharing?

Opportunities to partner with USACE and locals

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Likely reduction in long-term costs for emergency response and recovery through reduction in frequency of flooding.

Flood fighting? (Increase, Decrease, or No Significant Change)

Marginal to moderate decrease in flood fighting. Flood fighting cost due to insufficient freeboard are reduced, but other forms of flood fighting (boils, wavewash erosion, river erosion) are likely to remain unchanged.

Effect on Damage to Critical Public Infrastructure?

Reducing the risk of flooding reduces the likelihood of damage to critical public infrastructure.

Effect on Floodplain and Economic Development?

Reduces the frequency of flooding and increases level of flood protection, which may encourage development in the floodplain

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential to reduce State flood responsibility by reducing the frequency of overtopping. However, State flood resonsibility may increase if the floodplain and economic development above occurs. Responsibilities to maitain facilities remain unchanged.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

None

Adverse Environmental Impact?

Raising levees could result in substantial permanent impacts to terrestrial habitat including loss of habitat for special-status species. This action also could moderately alter physical processes (including sediment transport) that could result in permanent impacts to habitat for aquatic and riparian species.

Permitting Considerations?

Extensive and complex

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Improves level of flood protection by reducing the frequency of flooding; residual risk remains and may increase if floodplain development increases.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

No other benefits identified

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Improving the level of flood protection is politically desirable, particularly in urban and urbanizing areas.

Technical Considerations:

Redirected Hydraulic Impacts?

Increasing the carrying capacity of the channel may result in downstream impacts, particularly in downstream areas with lower levels of flood protection. Additional flood flows that would have historically escaped channel would be conveyed downstream.

Residual Risk?

Reduces the frequency of flooding. May increase residual risk if floodplain development is encouraged.

Climate Change Adaptability:

Raising levees could enhance hydrologic adaptability by increasing system capacity. However, this action could adversely impact biological adaptibiity by reducing ability to for floodplain species and habitats to handle more extreme conditions.

Urban, Small Community, and Non-Urban Considerations:

Raising existing levees may be most appropriate in established urban areas where land is at a premium and other flood protection measures are not feasible. Considerations should also be given to the height of levees bordering both banks of a river or channel; as raising only one side may impact the risk of flooding the opposite side.

Regional Applicability:

Raising levees can be performed systemwide, provided adjacent land is available for landside toe migration.

Integration with Other Programs:

Flood Projects Office; Channel Evaluation Program

References:

USACE 2001 Sacramento and San Joaquin River Basins Comprehensive Study;

DRAFT Management Action Evaluation

Management Action Title: MA-022

Construct setback levees.

Description:

Problem:

Insufficient flow capacity in some reaches of the flood management system due to levees that constrict the channel and reduce the natural capacity of floodplains to provide flood storage and conveyance, and can cause sedimentation and scour in unanticipated places due to changes in sediment transport dynamics. In addition, in some reaches, existing levees are built on poor or unsuited foundation and cost of retrofit are high or unfeasible. The geology may be far more conducive to a repair by setting the levee back on a more favorable foundation.

Desired Outcome:

Increased flow capacity between the levees and improved structural integrity by constructing setback levees.

Methodology:

Expanding channel capacity by setting levees back from the main river could provide a sustainable approach by enhancing flood system performance and reducing levee erosion over the longer-term. Assessing setback levees would take into consideration various factors, including: existing flood easements; willingness of land owners to participate in the action; ground foundation; existing transportation features and infrastructure; hydraulic modeling; opportunities for habitat, recreation, and agricultural enhancement; and potential erosion reduction.

CVFPP Goals

Contributes Significantly to: Improve Flood Risk Management

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☑ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☑ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retain; look for opportunity.

Advantages:

- Increased floodplain storage reduces the State exposure to flood responsibility.
- More sustainable than traditional levees. Reduces O&M Costs.
- Promotes multiple benefits in addition to reduction of flood risk (habitat, recreation, open space).
- Provides the opportunity to rehabilitate and accommodate fluvial geomorphic processes and flow regimes, increase the quantity, diversity, and connectivity of riparian and wetland habitats, provide access for migrating fish, recreating frequently activated floodplains within a majority of the natural river system.
- Improved structural integrity of levees by using modern construction standards.
- Decrease the geotechnical risk factors by palcing the levee on good foundation.

Disadvantages:

- Potentially high capital cost.
- May result in downstream hydraulic impacts due to increased channel capacity.
- Length permitting.
- Land aquistions and easements for access can be difficult

Economic Considerations:

Capital Cost? (High, Medium, Low)

High capital costs for real estate acquisition and new construction.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

No significant increase in maintenance cost, with potnetial for reduced long-term costs. Reduced channel maintenance costs (vegetation management, sediment removal) and reduced scouring and erosion in comparison to traditional levees may reduce long-term O&M costs.

Potential for Cost-Sharing?

Opportunities to partner with USACE and locals

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Likely reduction in long-term costs for emergency response and recovery through reduction in frequency of flooding.

Flood fighting? (Increase, Decrease, or No Significant Change)

Likely reduction in floodfighting costs through reduction in frequency of flooding. New levee would be constructed to current standards, minimizing the need for flood fighting operations.

Effect on Damage to Critical Public Infrastructure?

Reducing the risk of flooding reduces the likelihood of damage to critical public infrastructure.

Effect on Floodplain and Economic Development?

Reduces the frequency of flooding and increases level of flood protection, which may encourage development in the floodplain.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential to reduce State flood responsibility by reducing the frequency of flooding, unless floodplain development occurs.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

The construction of setback levees could rehabilitate key physical processes by reconnecting channels to historical floodplains, and enhancing sediment transport, channel and floodplain forming processes, groundwater recharge, and improving water quality, and would rehabilitate ecological functions by increasing riparian and wetland habitat area, quality diversity and connectivity, and by increasing spawning habitat (e.g., for Sacramento splittail) and salmonid rearing habitat.

Adverse Environmental Impact?

Constructing setback levees would result in moderate to substantial permanent impacts to terrestrial and agricultural habitats, and potentially to canal or seasonal wetland habitats, and in impacts to associated special-status species.

Permitting Considerations?

Extensive and complex

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

The magnitude of adverse effects to habitats resulting from flood system O&M would be reduced. Setting back levees provides the opportunity to rehabilitate and accommodate fluvial geomorphic processes and flow regimes, reducing erosion and scouring and the need for channel maintenance.

Social Considerations:

Public Safety?

Improves level of flood protection by reducing the frequency of flooding; residual risk remains and may increase if floodplain development increases.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Can provide open space, recreation, and habitat benefits. Potential for multiple-use trail alignments and connectivity by allowing public access to top of berm.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Setback levees offer multiple benefits and high in implementation likelihood where feasible. Improving the level of flood protection is politically desirable. Desirable environmental benefits. However, high capital costs and land acquisition challenges may present a challenge to widespread implementation.

Technical Considerations:

Redirected Hydraulic Impacts?

Potential to reduce downstream impacts due to increased floodplain storage capacity

Residual Risk?

Reduce flooding frequency; thereby residual risk.May increase residual risk if floodplain development is encouraged

Climate Change Adaptability:

This action would enhance hydrologic adaptability by increasing water management flexibility. This action also could enhance biological adaptabiity by increasing the quantity, connectivity, and complexity of floodplain habitats and their continuity along environmental gradients; and thus, enhance the ability of species to handle and adjust to the consequences of climate change.

Urban, Small Community, and Non-Urban Considerations:

Construction of new setback levees requires land acquisitions that may not be feasible in urban areas due to land availability limitations.

Regional Applicability:

Construction of setback levees can be limited in some areas due to development and sensitive habitat areas, like the Delta.

Integration with Other Programs:

Flood Projects Office; Fish Passage Improvement Program; Integrated Regional Water Management Program;

References:

USACE 2001 Sacramento and San Joaquin River Basins Comprehensive Study;Environmental Sustainability Summary;Sacramento River Bank Protection Project Draft Environmental Assessment/Initial Study for Levee Repair of 25 erosion sites; Delta R

DRAFT Management Action Evaluation

Management Action Title: MA-023

Construct ring levees.

Description:

Problem:

There are small communities and critical infrastructure that are at risk of flooding, either because they have no flood control protection or the existing flood control protection is insufficient and unreliable.

Desired Outcome:

Protection of small communities and critical infrastructure by construction of ring levees or internal levees.

Methodology:

Reduction in food risk to small communities and individual structures can be achieved by constructing ring levees or internal levees. A ring levee is constructed around the protected area, isolating it form potential flood waters. Internal levees, on the other hand, serve as a second line of defense by compartmentalizing and isolating portions of the protected area. Both ring and internal levees can be used as secondary lines of defense. Ring levees can also act as the primary line of defense in the absence of other forms of flood control. Ingress and egress to the area protected may be difficult if the levee is more than a few feet tall because long ramps may be required to provide vehicular passage over the top of the levee.

CVFPP Goals

Contributes Significantly to: Improve Flood Risk Management

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☐ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retain for further evaluation

Advantages:

- Reduces the frequency of flooding for small communities and structures.

Disadvantages:

- Potentially high capital cost.

Economic Considerations:

Capital Cost? (High, Medium, Low)

High capital costs to obtain real estate and construct new ring levees capable of protecting entire communities.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Increased O&M costs for new ring levees

Potential for Cost-Sharing?

Opportunities to partner with USACE and locals

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Likely reduction in long-term costs for emergency response and recovery through reduction in frequency of flooding of area surrounded by ring levee.

Flood fighting? (Increase, Decrease, or No Significant Change)

Likely reduction in floodfighting costs through reduction in frequency of flooding in areas surrounded by ring levees. However, in some areas, flood fighting may be impaired if the ring levee is surrounded by flood waters and no protected transportation corridors for ingress and egress are provided.

Effect on Damage to Critical Public Infrastructure?

Ring levees and internal cross levees will reduce the frequency of flooding, and therefore will reduce damages to critical public infrastructure located inside the ring. No impact on critical infrastructure outside of the ring levee.

Effect on Floodplain and Economic Development?

Little to no impact on floodplain development

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential to reduce State flood responsibility by reducing the frequency of flooding in the area protected by the ring levee. May increase State flood liability by expanding project-levee system

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

None

Adverse Environmental Impact?

Substantial permanent impacts including loss of terrestrial and potentially wetland habitat, including potential loss of habitat for special-status species, and potential reduction in habitat connectivity.

Permitting Considerations?

Extensive and complex

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Improves level of flood protection by reducing the frequency of flooding in isolated areas; residual risk of flooding remains.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Levees have the potential for establishment of a recreational trail on top. Loop trails are popular and can be potentially supported by ring levees.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Improving the level of flood protection is politically acceptable.

Technical Considerations:

Redirected Hydraulic Impacts?

Little to no redirected downstream impacts for smaller ring levees. Larger ring levees may increase downstream impacts of flood events. Internal cross levees do not affect hydraulic conveyance, but control inundation zones.

Residual Risk?

Reduce the residual risk for areas inside ring levee. May increase risk if additional development occurs inside the ring levee.

Climate Change Adaptability:

This action would reduce biological adaptability because it would reduce habitat quantity and potentially habitat connectivity, and thus, reduce the ability of species to handle and adjust to the consequences of climate change.

Urban, Small Community, and Non-Urban Considerations:

Construction of ring levees is most appropriate for small communities.

Regional Applicability:

Construction of ring levees can be performed at any portion of the system where small communities or structures require a greater level of flood protection.

Integration with Other Programs:

Flood Projects Office; transportation corridors

References:

USACE 2001 Sacramento and San Joaquin River Basins Comprehensive Study;

DRAFT Management Action Evaluation

Management Action Title: MA-024

Improve structural performance of existing levees.

Description:

Problem:

Existing levees in certain areas do not have structural deficiencies that make them under increased risk for slope or seepage failures or overtopping. The embankment geometry of certain existing levees is substandard, either narrow crown, short, and/or with steep slopes. These deficiencies may be reflected in persistent slope failures (oversteepened slopes), impaired access to and from levees (narrow crown) or insufficient freeboard (levee too short). Steep waterside slopes on levees adjacent to rivers also promote development or erosional features that further destabilize the levee embankment. Certain levee reaches are prone to develop severe through and/or under-seepage problems during medium- to high-water events. Seepage through the levee embankment may induce internal erosion, surface raveling, and a destabilizing effect on the levee embankment. Under-seepage, manifested by upward flowing sand boils near and away the landside levee toe, washes off fine-grained sediments, reduces the stability of the levee embankment and creates severe internal erosion. Both forms of seepage, if uncontrolled, may result in a levee breach.

Desired Outcome:

Reduce the risk of slope or seepage failure on existing levees

Methodology:

Levees are strengthened to enhance their integrity by improving the embankment soil properties and geometry to resist slope and seepage failures. Improving levee's resistance to slope failure is achieved by enlarging levees through adding material to widen the top width, flatten steep slopes, or both. Material can be added on the landside of a levee to increase stability by widening the crown and/or descreasing the side slopes. Adding material on the waterside can be used in some situations, but is not desired because of constriction to the waterway. Methods to address seepage include seepage berms, impermeable barrier curtains (slurry cut-off wall) in the levee and/or its foundation, and relief wells and toe drains.

CVFPP Goals

Contributes Significantly to: Improve Flood Risk Management

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☑ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☐ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained

Advantages:

- Reduces the risk of levee failure and improves reliability.

Disadvantages:

- Potentially high capital cost. Land requirements for increased levee footprint.
- Potentially increased environmental permitting and mitigation costs.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Moderate to high initial capital costs depending on the extent and type of levee modification.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

No change or slight reduction in O&M costs as previous costs associated with levee repairs are minimized.

Potential for Cost-Sharing?

Opportunities to partner with USACE and locals

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Reduces emergency response and recovery costs because of improved reliability of existing flood management system, provided land uses remain unchanged.

Flood fighting? (Increase, Decrease, or No Significant Change)

Reduces flood fighting costs because of improved reliability of existing flood management system.

Effect on Damage to Critical Public Infrastructure?

Reduces damage to critical public infrastructure because of improved reliability of existing flood management system.

Effect on Floodplain and Economic Development?

No effect on floodplain development because of no change to the level of protection from improved reliability of existing flood management system.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Improved reliability of existing flood management system reduce State financial exposure resulting from catastrophic failures.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

None

Adverse Environmental Impact?

If the footprint of the existing levees is expanded, it could result in substantial permanent impacts to terrestrial habitat including loss of habitat for special-status species. It could aslo moderately alter physical processes (including sediment transport) that could result in permanent impacts to habitat for aquatic and riparian species. In addition, construction related activities could result in substantial permanent impacts to terrestrial habitat including loss of habitat for special-status species.

Permitting Considerations?

Extensive and complex

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Improves public safety by improving reliability of the flood management system (level of protection remains unchanged).

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

No other benefits identified

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Improving the reliability of levees is politically desirable. However, costs and permitting considerations may present a challenge to widespread implementation.

Technical Considerations:

Redirected Hydraulic Impacts?

Minimal impacts

Residual Risk?

No change to residual risk because of no change to the level of protection from improved reliability of existing flood management system.

Climate Change Adaptability:

Improving structural performance of levees would not enhance hydrologic adaptability because system capacity remain unchanged.

Urban, Small Community, and Non-Urban Considerations:

Can be performed systemwide.

Regional Applicability:

Can be performed systemwide.

Integration with Other Programs:

Levee Distress and Levee Improvement Database (HAFOO), Information System Integration (HAFOO), California Levees Database (LRFMO), AB 156 Local Agency Assessment and Reporting (HAFOO), Flood Project Inspections and Reporting (HAFOO)

References:

DRAFT Management Action Evaluation

Management Action Title: MA-025

Acquire floodplain property that can contribute to flood management system efficiency.

Description:

Problem:

Much of the flood system has isolated floodplains from river and stream channels. Natural floodplains have been reduced due to limited understanding of their benefits, including their natural capacity for flood storage and conveyance. This has led to constrictions to flow that create flood hazards, present maintenance problems, and to loss of ecosystem quality and function. The constricted flow paths require that reservoirs hold flood flows and restrict and/or meter flows more often to control peak flows.

Desired Outcome:

Acquire or otherwise dedicate floodplain land that is now not subject to flooding to the flood management system in sufficient amounts and at appropriate locations so that the increased floodplain transient storage lowers flood peaks, restores river processes, enhances ecosystem value, and contributes to water supply management.

Methodology:

Lands adjacent to channels that currently or historically were flooded during periods of high flow would be inundated more frequently, at greater depths, or for longer periods of time during winter and spring. This would be achieved by reconnecting historical floodplains to channels using setback levees or by increasing the frequency with which existing connected floodplains are inundated by water that tops the bank. However, advantages of increasing floodplains must be balanced against the impact to existing land uses and critical infrastructure in floodplains. Acquisition of some property, whether land or structures, would occur as necessary to ensure the effectiveness of the flood management system. Plans would be developed to adequately replace lost property, revenue and uses of acquired lands and services. Relocating structures would be considered in high hazard areas where human occupancy is unsafe (e.g., where flooding occurs very rapidly) and where on-site flood proofing measures are inadequate (e.g., in areas where floodwaters are extremely deep). The use of voluntary flood easements would be explored, where feasible, to accommodate flood waters, preserve agricultural land, and provide habitat.

CVFPP Goals

Contributes Significantly to: Improve Flood Risk Management

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☑ Improve Operation and Maintenance
- ☑ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☑ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained, but requires further evaluation.

Advantages:

- Reduces both flood and residual risk.
- Reduces long-term emergency response and floodfighting costs.
- Increase public safety.
- Water supply improvement; ecosystem improvement.

Disadvantages:

- Potentially high capital cost.
- Potential terrestrial environmental impacts in floodplain inundation area.
- Potential public resistance due to high costs and relocations.
- Potential reduction in tax revenue.

Economic Considerations:

Capital Cost? (High, Medium, Low)

High initial investment depending on location and extent of floodplain acquisition (costs include real estate acquisitions,

relocations, mitigation costs, and levee construction costs). Long-term disaster cost avoidance may offset the costs.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Could increase costs for floodplain maintenance.

Potential for Cost-Sharing?

Potential for Federal cost sharing via contributions to existing Federal project purposes (flood management). Also potential for State and local cost sharing.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Potential to reduce long-term costs for emergency response and recovery through reduction in the frequency or magnitude of flooding outside the floodway and relocation of people and property. Could reduce emergency costs associated with levee repairs and failures because depth and velocity on levees would be diminished.

Flood fighting? (Increase, Decrease, or No Significant Change)

Potential to reduce the long-term cost of flood fighting due to decreased floodwaters and decreased populations in the floodplain.

Effect on Damage to Critical Public Infrastructure?

Potential to reduce damage to critical infrastructure due to lower velocity and reduced flood stage.

Effect on Floodplain and Economic Development?

Floodplain development could be discouraged in order to maintain the natural processes of the floodplain. This may lead to decreased tax revenue. Potential to improve water-supply reliability, which could support economic development.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential to reduce State liability through reduction in the frequency or magnitude of flooding and relocation of people and property.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

Could rehabilitate key physical processes (e.g., sediment transport balance and meander migration) and ecosystem functions by enhancing groundwater recharge, floodplain and channel forming processes, and water quality, and could enhance floodplain spawning habitat and salmonid rearing habitat, and rehabilitate floodplain riparian and wetland habitat.

Adverse Environmental Impact?

Moderate to substantial permanent impacts to terrestrial, agricultural, and potentially to seasonal or freshwater marsh wetland habitats, including potential loss of habitat for special-status species.

Permitting Considerations?

Minor

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

Habitats that have been affected by flood system O&M would be rehabilitated.

Social Considerations:

Public Safety?

Potential to increase public safety through reduction in the frequency or magnitude of flooding and relocation of people and property.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to create open space, recreation areas (trails, hunting, wildlife viewing), and natural habitats.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Large scale acquisition of floodplains is most likely not implementable due to cost and land availability. However, floodplain acquisition in smaller specific areas may be more feasible. Likelihood of implementability could increase if local communities are educated on the benefits of floodplains and contribute to land acquisition process (e.g., non-fee acquisitions and dedications).

Technical Considerations:

Redirected Hydraulic Impacts?

Potential reduction in downstream peak flows.

Residual Risk?

Reduces the frequency of flooding, and relocated people and property, reducing residual risk.

Climate Change Adaptability:

This action would enhance hydrologic adaptability by increasing water management flexibility. Reservoir capacity previously dedicated to controlling flood flows could instead be dedicated to water supply. Biological adaptibility could be enhanced by improving habitat connectivity and increasing habitat quantity to sustain population viability.

Urban, Small Community, and Non-Urban Considerations:

Region specific. Potential for reduction in tax revenues.

Regional Applicability:

Applicable in all regions with levees.

Integration with Other Programs:

Flood Corridors Program (Projects Office), Corridor Management Strategy (FMO), Central Valley Conservation Strategy (FESSRO)

References:

Flood Warning: Responding to California's Flood Crisis.;RCR; Environmental Sustainability Summary; USACE 2001 Sacramento and San Joaquin River Basins Comprehensive Study;

DRAFT Management Action Evaluation

Management Action Title: MA-026

Manage municipal stormwater to provide regional or systemwide flood benefits.

Description:

Problem:

Municipal storm flows exhibit accelerated runoff and higher peak flows than an undisturbed landscape. These characteristics create more scour, higher stages, more dangerous channel velocities, and generally more destructive flows, and they occur over a shorter period of time than flows from an undisturbed watershed. Both locally in individual catchments, and collectively across regions or basins, this shift in runoff can increase the risk of flood damage to property and the ecosystem.

Desired Outcome:

Develop municipal stormwater improvements to improve flood management while also providing other benefits, such as ecosystem functions.

Methodology:

CVFPP Goals

Contributes Significantly to: Improve Flood Risk Management

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☑ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained, but requires further evaluation.

Advantages:

- Potential to provide multiple benefits (e.g., recharge, water quality, habitat, local flood improvements, economic, cultural, social, aesthetic) with local, regional and statewide implications.

Disadvantages:

- Systemwide benefits uncertain.
- Moderate to high costs if implemented on large scale.
- Under jurisdiction of local municipalities; large-scale implementation may require new policies or incentives (e.g., funding) at regional or state level.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Low to moderate capital costs to implement on large scale, depending on methods employed

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Potential for Cost-Sharing?

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Flood fighting? (Increase, Decrease, or No Significant Change)

Effect on Damage to Critical Public Infrastructure?

Potential to reduce damage to critical public infrastructure through reduction in frequency or magnitude of local flooding, primarily in urban areas and small communities

Effect on Floodplain and Economic Development?

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

No change to State flood responsibility

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

Adverse Environmental Impact?

Permitting Considerations?

Yes

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

Social Considerations:

Public Safety?

Potential to increase public safety through reduction in the frequency or magnitude of localized flooding

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential for improvement of water quality, aquatic species migration and breeding, and water supply; may also support restoration of certain habitat types. Recreation, property value, openspace benefits may benefit local economy

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Stormwater management falls under local, municipal, and state jurisdictions; large-scale implementation (to provide systemwide flood benefits) would require coordination by a large number of local, municpalities, and state agencies, which would likely require changes to stormwater policies at a regional (Cities/Counties/Integrated Water Organizations), state (Water Boards), and federal (USEPA) level

Technical Considerations:

Redirected Hydraulic Impacts?

Stormwater programs will potentially alleviate adverse hydraulic impacts down stream

Residual Risk?

Climate Change Adaptability:

Coordinating stormwater management with flood operations has potential to enhance hydrologic adaptability at a local level; hydrologic alterations could enhance biological adaptability by reducing the adverse consequences of peak flows for habitats, and possibly by increasing the quantity and connectivity or continuity of habitat along environmental gradients

Urban, Small Community, and Non-Urban Considerations:

Location specific (cannot determine at this time)

ID #: MA-026

Regional Applicability:

Applicable in all regions where stormwater contributes to flood flows, or regions where recharge facilities exist

Integration with Other Programs:

References:

USACE 2001 Sacramento and San Joaquin River Basins Comprehensive Study; Boyle & Associates, 2008. Madera County Integrated Regional Water Management Plan;

DRAFT Management Action Evaluation

Management Action Title: MA-028

Coordinate and streamline floodplain mapping to improve consistency of floodplain delineation and assessment of flood risk.

Description:

Problem:

Floodplain boundaries provided by USACE, FEMA, and DWR are often different from each other due to variation in the available data and levee design criteria used. Inconsistencies between the floodplain boundaries of multiple agencies can cause public confusion regarding flood risk. Good floodplain mapping and related flood hazard data serve a crucial role in identifying properties prone to high flood risk. Local communities, State government, and the private sector require accurate, detailed maps to guide development, prepare plans for community economic growth and infrastructure, utilize the natural and beneficial function of floodplains, and protect private and public investments.

Desired Outcome:

Improve the accuracy of floodplain maps to allow for proper flood planning, maintenance, and emergency response.

Methodology:

OES would coordinate with other hazard mapping efforts to create, develop, produce, and disseminate GIS-based multi-hazard advisory maps and distribute them to local governments and the public. Such maps would pre-plan response options to foreseeable breach scenarios, or typical levee problem scenarios, which would expedite response at the time of the flood. This effort would involve the development of a comprehensive, unified floodplain-mapping program that would resolve discrepancies among current floodplain mapping boundaries. The program would develop a single, unified set of floodplain mapping standards for scale, accuracy, source data, and methodology to ensure consistent floodplain delineation and assessment of flood frequency and risk.

CVFPP Goals

Contributes Significantly to: Improve Flood Risk Management

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☑ Improve Institutional Support
- ☐ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained.

Advantages:

- Increases flood preparedness and awareness.
- Low cost.
- Discourages floodplain development.
- Consistent floodplain information will be available from all agencies.

Disadvantages:

- Need to standardize mapping criteria.
- Requires muliti-agency cooperation.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Relatively low capital cost to implement. Requires consensus on standards and database population.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Little or no change; database will need regular updates.

Potential for Cost-Sharing?

Cost-sharing is not necessary because little or no cost is associated with this management action.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Potential to reduce emergency resonse and recovery costs, due to increased flood preparadness and awareness.

Flood fighting? (Increase, Decrease, or No Significant Change)

No change to flood fighting costs.

Effect on Damage to Critical Public Infrastructure?

Potential to reduce damage to critical public infrastructure, due to increased flood preparadness and awareness.

Effect on Floodplain and Economic Development?

Floodplain development may be discouraged with increased awareness about what areas are particularly susceptible to increased flooding due to development.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential to reduce State liability through increased flood preparadness and awareness.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

None

Adverse Environmental Impact?

None

Permitting Considerations?

None

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Potential to increase public safety through increased flood preparadness and awareness.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to discourage activities that complicate flood management, such as development in floodplains.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Feasible and likely implementable.

Technical Considerations:

Redirected Hydraulic Impacts?

Potential to prevent increases in downstream flow if development is discouraged.

Residual Risk?

Potential to prevent increases in residual risk if development is discouraged.

Climate Change Adaptability:

This action is unrelated to hydrologic and biological adaptability.

Urban, Small Community, and Non-Urban Considerations:

Region specific (cannot determine at this time).

Regional Applicability:

Applicable in all regions where floodplain mapping is conducted.

Integration with Other Programs:

Central Valley flood Evaluation and Delineation (LRFMO), Best Available Maps (LRFMO), Levee Flood Protection Zone Maps (LRFMO), Map Modernization Program (FEMA), Awareness Floodplain Mapping Program (LRFMO),

References:

RCR; California Floodplain Mangement Task Force, 2002, Final Reccomendations Report; USACE 2001Sacramento and San Joaquin River Basins Comprehensive Study;

DRAFT Management Action Evaluation

Management Action Title: MA-029

Restore channel form and function to improve O&M and facilitate flood damage reduction.

Description:

Problem:

Natural river/stream channels are formed by fairly frequent runoff events. Often, these channels are not large enough to handle peak flows from larger (less frequent) floods. In addition, in many cases development have encroached into the floodplain and levee systems. This results in channels with inadequate capacity that can inhibit drainage and contribute to flooding. Narrow channels also tend to increase velocity, which can increase erosion and the risk of flood damage.

Desired Outcome:

Where applicable, channels could be enlarged enough to safely carry larger peak flows without causing excessive erosion or other damage to the flood management system.

Methodology:

Restoring channel form and function would involve excavating a new channel or enlarging an existing channel. This would increase channel capacity and/or decrease the channel velocity. Areas adjacent to the thalweg or low flow channel can also be used to encourage or maintain sensitive habitat while other sections of the channel prism can be maintained for flow. Restoring channel form and function could occur in an existing river channel, an existing floodway, or a transitory storage area.

CVFPP Goals

Contributes Significantly to: Improve Operation and Maintenance

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☑ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☑ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retain for further evaluation

Advantages:

- May reduce scour and erosion.
- May increase capacity.

Disadvantages:

- Permitting requirements
- Temporary imperilment to aquatic and riverine ecosystems

Economic Considerations:

Capital Cost? (High, Medium, Low)

Channelization projects would likely require a moderate level of initial investment due to permitting requirements and the need for mitigation and structural changes to the flood system.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Potentially decrease in the annual costs if mechanized equipment can be readily used to clear vegetation and sediment on a more regular basis without the need to initiate large scaled sediment and/or vegetation removal projects and associated permitting, design, and construction costs.

Potential for Cost-Sharing?

Potential for federal and local cost sharing for channelization projects that facilitate flood damage reduction or ecosystem benefits.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

No significant change in emergency response and recovery costs.

Flood fighting? (Increase, Decrease, or No Significant Change)

No significant change in flood fighting cost.

Effect on Damage to Critical Public Infrastructure?

Reduction in flood risk could reduce damage to critical infrastructure.

Effect on Floodplain and Economic Development?

Channelization may improve flood system reliability and reduce risk

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Although channelization could improve the capability of the channel to carry design flows, there would likely be no significant change in State Flood Responsibility.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

Generally, channelization does not contribute to rehabilitation of ecosystem functions. However, low flow channel can be used to encourage or maintain sensitive habitat while other sections of the channel prism can be maintained for carrying flood flows.

Adverse Environmental Impact?

This action could result in moderate to substantial temporary (and potentially permanent) impacts to upland, riparian, and aquatic habitats, and associated special-status species, depending on the design of the action.

Permitting Considerations?

Extensive and complex

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

The magnitude of adverse effects to habitats resulting from flood system O&M would be reduced if a low flow channel is incorporated into the design of the action.

Social Considerations:

Public Safety?

Improves public safety by reducing flood damages.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

None.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Likely acceptable at the State and local levels.

Technical Considerations:

Redirected Hydraulic Impacts?

Possibility for redirected hydraulic impacts due to changes in flow characteristics of the channel.

Residual Risk?

No significant change.

Climate Change Adaptability:

This action could enhance hydrologic and/or biological adaptability by increasing increasing capacity to convey flood flows, moderating damage from extreme events, and enhancing ability of habitats and species to handle (i.e., persist through or recover from) extreme events; however, effect on adaptability would depend on design of action.

Urban, Small Community, and Non-Urban Considerations:

No specific considerations identified.

Regional Applicability:

All regions

Integration with Other Programs:

Channel maintenance technical evaluations including hydraulic models and conveyance analysis (FMO), Evaluation of Hydraulic Carrying Capacity of Channels (HAFOO), Levee repairs Program (LRFMO)

References:

USACE 2001 Sacramento and San Joaquin River Basins Comprehensive Study;Boyle & Associates, 2008. Madera County Integrated Regional Water Management Plan;

DRAFT Management Action Evaluation

Management Action Title: MA-030

Perform clearing and snagging within channels.

Description:

Problem:

Snags are trees, limbs, or large bushes that have fallen into a stream or river. Once in the waterway, they can collect sediment or debris. While snags provide important ecosystem benefits, they can also migrate downstream and become stuck in the channel, which creates snag "islands" and reduces channel capacity. Snags can also cause property damage by becoming caught on bridges, pumping plants, docks, and other infrastructure. Debris also creates drag and reduces channel capacity. Small debris such as branches or trash can accumulate along the banks during normal flows, but while unsightly, are not a problem during large floods. Large debris can include furniture, appliances, or other large items that may have been illegally dumped into the flood channel. These items can easily be trapped on the river banks by snags, as well as by bridges or other similar infrastructure. Large debris can create significant backwater effects that reduce flood flow capacity. Some forms of vegetation in the channels can reduce flow velocities, obstruct debris movement, and increase sedimentation. Responsibility for vegetation management is ill-defined for most channels, which further complicates channel maintenance.

Desired Outcome:

Channels should be clear of snags and large debris to maximize capacity.

Methodology:

Clearing and snagging could be performed to remove snags and large debris located within channels.

CVFPP Goals

Contributes Significantly to: Improve Operation and Maintenance

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☑ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☐ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retain for further evaluation

Advantages:

- Reduce snag "islands", and increase channel capacity.
- Reduce damages to bridges, pumping plants, and other property.
- Could potentially increase channel capacity.

Disadvantages:

- Permitting requirements
- Significant riverine and aquatic ecosystem impacts

Economic Considerations:

Capital Cost? (High, Medium, Low)

Clearing and snagging projects would likely require a low level of initial investment. The lack of structural changes to the flood system would likely keep costs down relative to other actions.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

No significant change; although clearing and snagging within the channel may reduce O&M costs due to reduced sediment removal in channels, and reduced scour and erosion repair required at levees and bridges.

Potential for Cost-Sharing?

Potential for local cost sharing for clearing and snagging within channels.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

There would likely be no significant change in costs for emergency response and recovery.

Flood fighting? (Increase, Decrease, or No Significant Change)

No significant change in flood fighting cost.

Effect on Damage to Critical Public Infrastructure?

Potential to reduce scour and erosion repairs at bridges and other in channel infrastructure.

Effect on Floodplain and Economic Development?

Clearing and snagging may improve flood system reliability, but does not reduce flood risk.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Although clearing and snagging could potentially improve channel capacity, there would likely be no significant change in State Flood Responsibility.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

None

Adverse Environmental Impact?

Snagging would result in moderate to substantial temporary impacts to riparian habitat during removal and permanent impacts and loss of habitat for aquatic fish species foraging and rearing habitat including special-status species. Clearing of vegetation would result in substantial permanent impacts to riparian habitat, nesting birds, and aquatic species including special-status species.

Permitting Considerations?

Substantial

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Improves public safety by reducing flood damages.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Clearing and snagging may provide maintenance workers better visibility for potential problems.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Somewhat likely, but has low cost-effectiveness. In addition, this measure would reduce existing shaded riverine aquatic habitat, which is an important component to some ecosystem restoration programs.

Technical Considerations:

Redirected Hydraulic Impacts?

Possibility for redirected hydraulic impacts due to changes in flow characteristics of the channel.

Residual Risk?

No significant change.

Climate Change Adaptability:

This action would reduce biological adaptability by eliminating and simplifying habitat, and thus, reducing the ability of populations to handle and adjust to the consequences of climate change; but action could enhance hydrologic adaptability if it significantly increases flood flow capacity.

Urban, Small Community, and Non-Urban Considerations:

No specific considerations identified.

Regional Applicability:

All regions

Integration with Other Programs:

Vegetation Management Projects (FMO)

References:

USACE, 2001. Sacramento and San Joaquin River Basins Comprehensive Study;

DRAFT Management Action Evaluation

Management Action Title: MA-031

Perform dredging to remove sediment from channels.

Description:

Problem:

Sedimentation of natural channels reduces their flow-carrying capacity. Historically, hydraulic mining released great quantities of sediment into some foothill streams, which was carried into the valley and deposited wherever the gradient and flow rate no longer would support the bed load transport. Even though hydraulic mining is now discontinued, portions of these sediments remain in valley streams. Sedimentation in other areas is from erosion of riverbanks and levees and runoff from agricultural fields. Natural sedimentation also deposits large quantities of silt, sand, gravel, and rock at critical points like sand traps and other low energy areas where steep foothill streams become flat valley watercourses.

Desired Outcome:

Channels should be clear of accumulated sediment to maximize capacity.

Methodology:

Dredging could remove sediment from channels and can improve the hydraulic efficiency. Deepening the thalweg or creating one can increase the overall flow efficiency by increasing the velocity through it.

CVFPP Goals

Contributes Significantly to: Improve Operation and Maintenance

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☑ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☐ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retain for further evaluation

Advantages:

- Could increase channel capacity.

Disadvantages:

- Permitting requirements.
- Significant aquatic ecosystem impacts.
- Dredge tailings disposal - potential hazardous materials in sediment.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Dredging projects would likely require a medium to high level of initial investment. The need for mitigation and dredge tailings disposal would likely make costs higher relative to other actions.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

No significant change, although dredging may reduce O&M costs due to less scour and erosion repair.

Potential for Cost-Sharing?

Potential for local cost share in areas needing improved channel conveyance and limited ecosystem constraints.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

No significant change in costs for emergency response and recovery.

Flood fighting? (Increase, Decrease, or No Significant Change)

No significant change in floodfighting cost.

Effect on Damage to Critical Public Infrastructure?

No significant change.

Effect on Floodplain and Economic Development?

Dredging may have little to no effect on floodplain development.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Although dredging could potentially improve channel capacity, there would likely be no significant change in State Flood Responsibility.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

None

Adverse Environmental Impact?

This action would result in moderate to substantial temporary impacts to riparian and aquatic habitat (fish spawning and rearing habitat) including special-status species. It also would result in minor to moderate alteration of physical processes, including flow regime (e.g., magnitude, and duration of flows) and sediment transport, that could result in permanent impacts to habitat for aquatic and riparian species.

Permitting Considerations?

Considerable and extensive; can be very costly and time consuming.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Improved public safety by increasing the reliability of channels to pass flood flows.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Unlikely to provide other benefits than increasing channel capacity.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Somewhat likely, but has low cost-effectiveness, and would need to be performed in low environmental impact areas.

Technical Considerations:

Redirected Hydraulic Impacts?

Possibility for redirected hydraulic impacts due to changes in flow characteristics of the channel.

Residual Risk?

No significant change.

Climate Change Adaptability:

This action could enhance hydrologic adaptability if it significantly increases flood flow capacity; but, action also could reduce biological adaptability by disturbing and simplifying aquatic habitats, and thus, reducing the ability of populations to handle and adjust to the consequences of climate change.

Urban, Small Community, and Non-Urban Considerations:

No specific considerations identified.

Regional Applicability:

All regions

Integration with Other Programs:

Delta Dredged Sediment Long-Term Management Strategy (USACE)

References:

USACE, 2001. Sacramento and San Joaquin River Basins Comprehensive Study; Agricultural Stewardship White Paper;

DRAFT Management Action Evaluation

Management Action Title: MA-032

Reuse excess materials derived from channel maintenance.

Description:

Problem:

Waste materials are created during channel maintenance activities such as dredging and clearing and snagging. It is necessary to transport and dispose of these materials, which can be costly.

Desired Outcome:

These materials should be reused to minimize waste and transportation costs. This also reduces negative impacts to the environment including carbon emissions and disposal to landfills.

Methodology:

Beneficial reuses for waste materials from channel maintenance activities should be identified. Dredged sediment, if it does not contain hazardous materials, could be used as fill material in the proper locations.

CVFPP Goals

Contributes Significantly to: Improve Operation and Maintenance

Potentially Contributes to (Check all that apply):

- ☐ Improve Flood Risk Management
- ☑ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☐ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retain for further evaluation

Advantages:

- May reduce transportation costs for disposal.
- May reduce disposal costs.

Disadvantages:

- Permitting requirements.
- Potential hazardous materials in sediment.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Reuse of excess material would likely require a low level of initial investment, and would likely reduce costs versus disposal.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

No significant change to operate/maintain/repair.

Potential for Cost-Sharing?

High potential for local cost sharing to reduce overall disposal and transportation costs associated with channel maintenance.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

There would likely be no significant change in costs for emergency response and recovery.

Flood fighting? (Increase, Decrease, or No Significant Change)

No significant change in floodfighting cost.

Effect on Damage to Critical Public Infrastructure?

No significant change.

Effect on Floodplain and Economic Development?

Not likely to have an effect on floodplain development.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Reuse of excess materials would likely provide no significant change in State Flood Responsibility.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

None

Adverse Environmental Impact?

None

Permitting Considerations?

None

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Unlikely to have substantial public safety impacts.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Reuse of excess material may also reduce negative impacts to the environment including carbon emissions and disposal to landfills.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Reuse of excess materials would be highly likely to be implemented due to the potential cost savings and reduction in negative impacts to the environment.

Technical Considerations:

Redirected Hydraulic Impacts?

No redirected hydraulic impacts.

Residual Risk?

N/A

Climate Change Adaptability:

This action is unrelated to hydrologic and biological adaptability.

Urban, Small Community, and Non-Urban Considerations:

No specific considerations identified.

Regional Applicability:

All regions

Integration with Other Programs:

Delta Dredged Sediment Long-Term Management Strategy (USACE)

References:

Agricultural Stewardship White Paper;

DRAFT Management Action Evaluation

Management Action Title: MA-033

Develop regional vegetation management plans.

Description:

Problem:

When vegetation management has been deferred for several years due to funding or other constraints, excessive vegetation growth can result in the establishment of habitat that requires additional permits or mitigation before maintenance activities can be conducted. Conflicting guidance and requirements in relation to vegetation and debris management can make it difficult for local agencies with limited budgets to conduct maintenance activities efficiently. USACE has national standards that limit vegetation on levees. This policy is in conflict with the vegetation management policies of other State and federal agencies.

Desired Outcome:

Develop vegetation management plan as part of corridor management that balance public trust concerns while maintaining the functionality of the flood management system and allows for regular maintenance to ensure public safety.

Methodology:

Architectural Landscape designs should be developed in coordination with structural designs and Corps Vegetation Policy.

CVFPP Goals

Contributes Significantly to: Improve Operation and Maintenance

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☑ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☑ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retain for further evaluation

Advantages:

- May improve bank stability.
- Would reduce costs of obtaining permits.
- Would provide multiple benefits along with flood risk reduction.

Disadvantages:

- Vegetation policy still in conflict with USACE vegetation on levee policy.
- Conflicting State and Federal public protection and public trust policies.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Unless variance is allowed by Corps to its Vegetation Policy, cost of mitigation to meet federal requirements is very high. Levee repairs have estimated intial costs varying from $6.5 billion to $7.5 billion to meet federal requirements.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Regional vegetation management plans would slightly increase annual O&M costs, but would likely be offset by a reduction in permitting and mitigation costs.

Potential for Cost-Sharing?

Cost sharing is applicable only to levee vegetation management, as LMAs will provide the bulk for O&M costs. The State and the Federal governments should help offset these costs and provide funds and assistance to help LMAs with environmental permitting.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

No significant change to emergency response and recovery cost. Vegetation management will improve the reliability of the system, and may restore channel capacity

Flood fighting? (Increase, Decrease, or No Significant Change)

Management of vegetation on levees would reduce long-term flood fighting costs, as it visibility and access. Vegetation on channels has an indirect and relatively minor effect on flood fighting such as tree debris in the water impacting food fighting operations.

Effect on Damage to Critical Public Infrastructure?

Minor impact. Vegetation debris from channels could potentially accumulate at choke points (i.e. bridge crossings) obstructing and impacting flow conveyance, negatively affecting in-channel and adjacent infrastructure.

Effect on Floodplain and Economic Development?

Not likely to have an effect on floodplain development.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Vegetation in channels is the responsibility of the State and Federal governments. The State has a large stake in assuring that the design flows are not reduced by vegetation. Vegetation management on levees is the responsibility of the locals, but since the State is the largest maintainer, it has a significant impact in implementing the vegetation policy.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

Regional vegetation management could rehabilitate key physical processes and ecosystem functions, if vegetation is managed to enhance physical processes, such as sediment transport and channel and floodplain forming processes, and to enhance riparian and wetland habitat values.

Adverse Environmental Impact?

Channel specific and unknown at this time.

Permitting Considerations?

Channel specific and unknown at this time.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

Impacts associated with flood system O&M could be reduced because O&M would be better facilitated and mitigation better coordinated.

Social Considerations:

Public Safety?

Unlikely to have substantial public safety impacts.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Developing regional vegetation management plans may enhance aesthetic, recreational and open space values within floodplains.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Likelihood of implementation is highly dependent on the ability to meet USACE guidelines for vegetation within the project works while reducing permitting and mitigation costs.

Technical Considerations:

Redirected Hydraulic Impacts?

Possible hydraulic impacts due to riparian vegetation removal required by the Corps. Changes in local flow velocities possible.

Residual Risk?

There will be a net reduction in risk

Climate Change Adaptability:

This action would reduce biological adaptability by reducing extent and quality (e.g., by reducing connectivity and complexity) of tree and shrub-dominated riparian habitats.

Urban, Small Community, and Non-Urban Considerations:

No specific considerations identified.

Regional Applicability:

All regions

Integration with Other Programs:

Major Vegetation Management Projects (FMO)

References:

RCR; Environmental Sustainability Summary; USACE. 2007. Treatment of Vegetation within Local Flood Damage Reduction Systems. Draft White Paper;

DRAFT Management Action Evaluation

Management Action Title: MA-034

Improve administration of encroachment permits.

Description:

Problem:

The CVFPB, in cooperation with the USACE, are responsible with processing, reviewing, issuing, and administrating permits for structures that encroach on project levees. The permitting process is lengthy. Currently there is a back log of about 180 days for issuing permits for new structures. In addition, there are hundreds of permitted encroachments that are not properly maintained and hundreds of unpermitted encroachments. In fall 2007, DWR identified approximately 129 miles of partially obstructing and 7 miles of completely obstructing encroachments (DWR, 2008e). Unmaintained or unpermitted encroachments may jeopardize levee integrity, raise the water surface level of design floods or flows, increase the damaging effects of flood flows, and impair inspection, maintenance and flood fighting. DWR reports newly discovered unauthorized encroachments to the Board and works with LMAs to abate unauthorized encroachments. Each LMA is held responsible for preventing the construction of, or requiring the removal of, any illegally encroaching structures on the levee and for stopping any unauthorized modifications to the levee (DWR, 2008e). However, some LMAs may lack the resources to force the removal of illegal encroachments.

Desired Outcome:

A streamlined permitting process. Proper administration of existing permits. Modernization of the permits database. More vigorous enforcement of unauthorized permits.

Methodology:

The State can work to improve the administration of encroachment permits by working with LMAs to remove illegal encroachments and improve enforcement of unauthorized and under-authorized permits. The State should also improve management of historic permits data by modernizing the repository of encroachment permits.

CVFPP Goals

Contributes Significantly to: Improve Operation and Maintenance

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☑ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☑ Improve Institutional Support
- ☐ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retain for further evaluation

Advantages:

- Will reduce the number of poorly maintained and unpermitted encroachments.
- Will make inspection of levees easier by removing encroachments.
- Will shorten the permit approval time.

Disadvantages:

- With the large number of unpermitted encroachments, could add significant administrative work.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Low. Policy MA's will tend to have a substantially lower capital cost than other MAs which involve physical construction.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

No significant change.

Potential for Cost-Sharing?

Potential cost-sharing with federal agencies, other state agencies, as well as local agencies. Before cost sharing with other entities, the CVFPB needs to modernize and stream line the permitting process.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

No change.

Flood fighting? (Increase, Decrease, or No Significant Change)

Accessibility to all permits, properly categorized and spatially georeferenced, will be invaluable for the Flood Operation Center in coordinating flood fighting operations during high-water events.

Effect on Damage to Critical Public Infrastructure?

Improving the administration of encroachment permits would likely have no significant effect on damage to critical public infrastructure.

Effect on Floodplain and Economic Development?

Not likely to have an effect on floodplain development.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Improving the administration of permitted structures will LIKELY improve flood management and the state flood responsibility as critical information will be more easily accessible.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

None.

Adverse Environmental Impact?

None.

Permitting Considerations?

The encroachment permitting process needs to be part of the overall permitting process.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None.

Social Considerations:

Public Safety?

Potential to improve public Safety by reducing poorly maintained and illegal encroachments.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

No immediate effect

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Feasible and likely implementable.

Technical Considerations:

Redirected Hydraulic Impacts?

None.

Residual Risk?

No change in residual risk.

Climate Change Adaptability:

This action is unrelated to hydrologic and biological adaptability.

Urban, Small Community, and Non-Urban Considerations:

No specific considerations identified.

Regional Applicability:

All regions.

Integration with Other Programs:

References:

DRAFT Management Action Evaluation

Management Action Title: MA-035

Improve administration and oversight of levee penetrations.

Description:

Problem:

Many levees in the Sacramento and San Joaquin river basins have locations where irrigation lines, drainage outlets, and other utilities have been piped through the levee. Some of these penetrations are engineered but the majority are not and poses a potential threat to the integrity of the levees. Leaks through the levee resulting from the penetrations can cause excessive levee material loss. In some instances, a surface expression of the levee material loss is visible soon after the leak manifests itself, especially on sandy levee embankments. However, if the levee composition is clayey, the leak may cause internal ground loss that may not be detected until a sinkhole appears on the levee surface. These hidden voids pose a serious threat to the structural integrity of the levee, which threatens the areas protected by the levee.

Desired Outcome:

An inventory of all penetrations, permitted and otherwise, creation of a database for all penetrations, and an assessment of deficiencies associated with penetrations. Establishment of a protocol to periodically conduct non-invasive testing on levee penetrations to assess their deterioration and recommend an adequate course of action. Upgrading standards for construction of new penetrations (i.e., use of stainless steel pipe for portions of penetrations within the CVFPB right-of-way.)

Methodology:

Improve administration and oversight of levee penetrations by creating a data management system to track, evaluate and permit penetrations.

CVFPP Goals

Contributes Significantly to: Improve Operation and Maintenance

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☑ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☐ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retain for further evaluation

Advantages:

- Continuous testing cycle can reveal penetrations that are deteriorating.
- They can be replaced before any damage to the levee embankment occurs.

Disadvantages:

- Could add significant administrative work.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Variable depending on the type and function of the penetration in question.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Low to moderate, most of the annual costs are associated with physical testing of levee penetrations that pose the highest hazard to flood protection.

Potential for Cost-Sharing?

Potential cost sharing with maintainers, operators, as well as State and federal agencies.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Low to none.

Flood fighting? (Increase, Decrease, or No Significant Change)

If deficient levee penetrations are located and are repaired or replaced, flood fighting costs should decrease as result of increased structural integrity of the levee.

Effect on Damage to Critical Public Infrastructure?

Repairing and replacement of deficient levee penetration will improve the levee's structural integrity and lower the risks of flooding.

Effect on Floodplain and Economic Development?

Increase in the structural integrity of the levees and thereby lowering the risks to flooding may induce further developments.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Although stated responsibility will not change, inability of LMAs to repair or replace deficient levee penetrations could induce the state to response.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

Project dependent - repair on or relocation of levee penetration may have temporary impacts to riparian or other habitats

Adverse Environmental Impact?

Project dependent - repair on or relocation of levee penetration may have temporary impacts to riparian or other habitats

Permitting Considerations?

Project dependent - repair on or relocation of levee penetration may have temporary impacts to riparian or other habitats

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None.

Social Considerations:

Public Safety?

Public safety benefits could come from improving levee stability by repairing or replacing deficient levee penetrations.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

No immediate effect

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Feasible and likely implementable.

Technical Considerations:

Redirected Hydraulic Impacts?

None.

Residual Risk?

Knowledge of the locations of pipe encroachments leads to a better understanding of potential risks from such encroachments, leading to identification of problem locations (e.g. leaking pipes requiring retrofit/replacement), and resulting in reduced risk to the flood protection system.

Climate Change Adaptability:

This action is unrelated to hydrologic and biological adaptability.

Urban, Small Community, and Non-Urban Considerations:

Need to engage the owners and operators of levee penetrations. Small and non-urban communities may not have the necessary budget to address deficiencies found.

Regional Applicability:

All regions.

Integration with Other Programs:

Flood Control Facilities Operation and Maintenance Program (FMO) Levee Operations and Maintenance Program (FMO) Pipe Inspection Program (FMO)

References:

n/a

DRAFT Management Action Evaluation

Management Action Title: MA-036

Improve interior drainage.

Description:

Problem:

Localized flooding can occur even while the larger conveyance paths for the mainstem rivers are performing well. Flooding can occur at local scales that nest, or influence other scales. A flood of a small stream can create discharge that leads to flooding of its receiving stream or channel. Similarly a receiving channel can flood, backing up water to the point of flooding a tributary channel. Managing the potential for flooding at each scale requires direct attention at that scale and an understanding of the likely effects that can be produced in, or delivered from watersheds of different scales.

Desired Outcome:

Improve interior drainage by channeling runoff to prevent flooding and help eliminate backwater effects and ensure each watershed has sufficient capacity.

Methodology:

Interior drainage could be improved by modifying or constructing new outfalls; for example, outfalls with flap gates can prevent backflow from rivers or channels into interior areas during high water events. Similarly, new or improved pump stations could convey interior drainage over levees or other flow barriers associated with the flood management system. Improvements could also include constructing new interior drainage detention/retention facilities to reduce or attenuate outflows to the flood management system.

CVFPP Goals

Contributes Significantly to: Improve Operation and Maintenance

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☑ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☐ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained; requires further evaluation to assess the potential to provide significant systemwide flood management benefits

Advantages:

- Reduces localized, interior flooding.
- Reduces accumulation of water behind levees.

Disadvantages:

- Moderate to high capital costs.
- Potential to increase outflows to flood management system.
- May not provide significant systemwide flood management benefits.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Moderate to high cost depending on specific actions/methods

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Little or no change to O&M costs associated with flood management system; O&M costs would fall on local entities

Potential for Cost-Sharing?

Some opportunity for cost-sharing.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Lower emergency response and recovery costs

Flood fighting? (Increase, Decrease, or No Significant Change)

Probably lower incidence of flood fighting

Effect on Damage to Critical Public Infrastructure?

Potential to reduce damage to critical public infrastructure through reduction in frequency or magnitude of interior flooding and accumulated water

Effect on Floodplain and Economic Development?

Better managing flood risk in low order watershed improves reliability of infrastructure and investments, leading to better economic development potential.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

No change to State flood responsibility

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

Could have significant improvement, be neutral, or impair ecological functions.

Adverse Environmental Impact?

Possibly.

Permitting Considerations?

Normal

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

Some

Social Considerations:

Public Safety?

Potential to increase public safety through reduction in the frequency or magnitude of localized, interior flooding

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Depends on specific solutions brought forward.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Interior drainage is typically a local function and implementation would depend on local resources, needs, and acceptability

Technical Considerations:

Redirected Hydraulic Impacts?

Little potential to increase downstream flood flows by increasing outflows from interior areas; timing of increased outflows unlikely to coincide with flood system peak flows

Residual Risk?

No change in residual risk

Climate Change Adaptability:

None

Urban, Small Community, and Non-Urban Considerations:

Location specific (cannot determine at this time)

Regional Applicability:

Applicable in all regions with interior drainage problems

Integration with Other Programs:

Could be fully integrated with a wide array of programs or could be pursued as single minded narrow program.

References:

Mokelumne/Amador/Calaveras IRWMP - Draft. November, 2006;

DRAFT Management Action Evaluation

Management Action Title: MA-037

Protect vulnerable levees and banks through stabilization and erosion repairs.

Description:

Problem:

In many levee reaches, the flood control channels were designed to flush out sediments that accumulated in the Sacramento River system from hydraulic mining activities in the late 1800s. These designs altered the natural balance of erosion and deposition in the channels and flushed out a majority of the mining debris. However, with much of the debris removed, the flows are now eroding the natural channel banks and the flood protection levees placed on them. Furthermore, many of the earlier levees were not engineered and were made with readily available materials dredged from the adjacent river. Poor levee foundations, geometry, or soil materials in some areas have further exacerbated erosion problems. Without bank protection, this erosion can encroach on existing levees and ultimately result in levee failure and major flooding. Floodwaters are erosive and, while moving along typically unprotected levees, need only encounter one weak spot in the system to cause a breach and potential loss of life or property. Extremely high hydraulic gradients can find other weak spots in the foundation materials and begin to migrate, or erode material from the foundation, creating unstable conditions quickly followed by total or significant structural failure (FEAT, 1997a). This ongoing erosion causes more damage than can be repaired by the State or levee maintaining agencies (LMA) using standard maintenance programs (DWR, 2005b).

Desired Outcome:

A long range solution to perform proactive repairs on damaged sites exhibiting signs of under seepage, erosion, or instability, so they do not reach a critical state of failure.

Methodology:

River erosion repair and bank stabilization, particularly when done in emergency situations, are made using rock riprap to armor and stabilize the bank. If conducted as part of an ongoing inspection and maintenance program, erosion repair and bank stabilization can be made more environmentally friendly by including sloping riparian benches with vegetation on the bench for bank stabilization and riparian habitat. Instream habitat, such as log and debris structures to direct flows away from the levees could also be created as part of these repair activities.

CVFPP Goals

Contributes Significantly to: Improve Operation and Maintenance

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☑ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☐ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retain for further evaluation

Advantages:

- Improves levee performance.
- Provides greater flood protection.

Disadvantages:

- Permitting requirements.
- Damage to aquatic and riverine ecosystems.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Protecting vulnerable levees and banks through stabilization and erosion repairs has a medium to high cost due to structural changes and potential mitigation as compared to other actions.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Protecting vulnerable levees and banks through stabilization and erosion repairs can decrease annual operations and maintenance costs due to better performing levees and less erosion to repair in the future.

Potential for Cost-Sharing?

Potential cost-sharing with federal agencies, other state agencies, as well as local agencies.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Protecting vulnerable levees and banks through stabilization and erosion repairs may slightly decrease the response and recovery costs due to better performing levees.

Flood fighting? (Increase, Decrease, or No Significant Change)

Repairing damaged sites will decrease flood fighting costs.

Effect on Damage to Critical Public Infrastructure?

Region specific (cannot determine at this time)

Effect on Floodplain and Economic Development?

No direct effects; however, by increasing the stability of the levee, would reduce the frequency of flooding and increase level of flood protection, which may encourage development in the floodplain

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Relative to likely future conditions, may reduce the frequency of flooding, thereby could reduce State responsibility

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

Levee repairs that include riparian habitat benches and instream habitat elements would rehabilitate ecological functions, by increasing SRA cover and enhancing migration corridor habitat for fish and wildlife species.

Adverse Environmental Impact?

Depending on implementation, this action could result in potential temporary and permanent impacts to shaded riverine aquatic and riparian habitats including potential habitat loss for special-status species. Planting of native riparian vegetation could offset some of these impacts. Tree removal under Corps new Vegetation policy will have adverse environmental impacts.

Permitting Considerations?

Ongoing

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Likely to improve public safety due to improved levee performance.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Unlikely to provide other benefits besides improved levee performance and maintenance.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Likely acceptable at State level

Technical Considerations:

Redirected Hydraulic Impacts?

No redirected hydraulic impacts.

Residual Risk?

Residual risk will decrease.

Climate Change Adaptability:

This action would increase hydrologic adaptability by moderating potential damage, and could increase or decrease biological adaptability depending on existing habitat conditions and design of individual actions (e.g., extent of riparian and aquatic habitat removed vs. added), which together would determine the effect on habitat extent, connectivity, and complexity.

Urban, Small Community, and Non-Urban Considerations:

No specific considerations identified.

Regional Applicability:

All regions

Integration with Other Programs:

Small erosion repairs permit program (FMO), integration with federal; Sacramento Bank Protection, CalfedDelta Levee Stability and Corps PL84-99 Programs.

References:

Draft Levee Repairs Interim Framework; (FEAT, 1997a); (DWR, 2005b); Sacramento River Bank Protection Project Draft Environmental Assessment/Initial Study for Levee Repair of 25 erosion sites;Flood Warning: Responding to California's Flood Crisis.

DRAFT Management Action Evaluation

Management Action Title: MA-038

Revise O&M manuals and inspection criteria to promote best maintenance practices that support multi-benefits of the flood system.

Description:

Problem:

Outdated O&M manuals do not reflect the best maintenance practices to inspect, operate, and maintain levees most effectively. Many existing O&M manuals were prepared specifically to reduce flood risks, often with little consideration about how those O&M activities might affect other functions of the flood management system, including ecosystem functions.

Desired Outcome:

O&M manuals reflecting best maintenance practices and scientific based approach to multi-benefit management of the flood management system, and are in compliance with current laws and regulations.

Methodology:

Revise O&M manuals using the best available scientific and technical data to support multiple objectives and ecosystem benefits. The new O&M manuals should be complimentary to the multiple benefit system-wide flood management plan. While keeping public safety, flood system functionality/efficiency priorities, O&M manuals should not conflict with other uses of the system, such as water supply or ecosystem health. Operations and Maintenance documents should be reviewed and updated to reflect current maintenance intervals, laws, regulations, and policies. Levee inspection criteria should be modified or tiered based on the type of land use protected by the levee (urban, rural, or agricultural). Existing inspection criteria should be strengthened to include determination and location of non-standard levee sections and to implement repairs and/or replacements. Identify best management practices to prevent and minimize encroachments.

CVFPP Goals

Contributes Significantly to: Improve Operation and Maintenance

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☑ Improve Operation and Maintenance
- ☑ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☑ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained for further evaluation; look for opportunities to combine with management actions involving setback levees, ecosystem restoration, and floodplain storage.

Advantages:

- Establishing the framework for maintenance and operation of the flood control works in conjunction public trust issues may lower cost.

Disadvantages:

- Conflicting State and Federal policies related to vegetation on levee.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Low to Medium, depending on the number of manuals that need to be, and can be, updated to achieve these goals. Costs will include stakeholder engagement, modeling and assessment of different approaches, and finalizing the improved manuals. Revision of O&M manual may require congressional and State legislation to redefine the State-federal flood management for California.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Updating O&M manuals can decrease costs to operate/maintain/repair the flood system, as the revised manuals will better reflect existing conditions. Over the long term revisions could result in an increased workload and cost implications to the FMO office.

Potential for Cost-Sharing?

Potential for cost sharing with local agencies and Federal flood agencies.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Updating O&M manuals to reflect existing conditions has potential to reduce flood frequency and decrease emergency response and recovery costs.

Flood fighting? (Increase, Decrease, or No Significant Change)

Potential to reduce the frequency (and long-term cost) of flooding.

Effect on Damage to Critical Public Infrastructure?

Region specific (cannot determine at this time)

Effect on Floodplain and Economic Development?

Potential increase pressure from development if the risk of flooding is decreased.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Improved O&M has the potential to reduce the frequency (and long-term cost) of flooding. No significant change of effect on State flood responsibility.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

Including the enhancement of physical processes and ecosystem function in O&M could rehabilitate those processes and functions, because currently multiple objectives are not optimized in O&M, which generally has a single FM focus.

Adverse Environmental Impact?

None

Permitting Considerations?

None

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

Impacts associated with flood system O&M could be reduced because O&M would be better facilitated and mitigation better coordinated.

Social Considerations:

Public Safety?

Potential to reduce frequency of flooding and improve level of flood protection by updating O&M manuals.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to provide recreation, open space, and water supply benefits. Review of O&M criteria would also be an opportunity to evaluate potential benefits to recreation and fish and wildlife enhancement that could persist after flood season is over.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Potential; however, concerns over limiting the flexibility to maintain integrity of the flood management system must be overcome.

Technical Considerations:

Redirected Hydraulic Impacts?

Potential upstream and downstream hydraulic impacts if new O&M manuals call for altered flow regimes and storage requirements.

Residual Risk?

May reduce the frequency of flooding, reducing residual risk to existing development.

Climate Change Adaptability:

This action could increase biological adaptability by increasing opportunities to provide habitat, or increase habitat quality (e.g., by increasing connectivity or complexity), and thus, sustain populations under a range of conditions, including extreme flow events.

Urban, Small Community, and Non-Urban Considerations:

No specific considerations identified.

Regional Applicability:

Not applicable in Delta Region, but may be used to reduce hydraulic impacts to Delta.

Integration with Other Programs:

Corridor Management Strategy (FMO)

References:

Environmental Sustainability Summary;

DRAFT Management Action Evaluation

Management Action Title: MA-039

Reduce runoff through upper watershed management.

Description:

Problem:

Runoff from upper watershed source areas has increased, in varying extents, due to increases in impermeable surfaces in developed areas, soil compaction from agriculture, reductions in vegetative cover, incision of stream channels, and losses of wetlands. Runoff flood events will worsen in the next 50-100 years, as regional temperatures rise and winter precipitation falls more frequently as rain, rather than snow. The increased intensity and frequency of winter flooding may overwhelm the existing flood management system on a more regular basis, unless other efforts are taken.

Desired Outcome:

Improved upper watershed management to enhance ecosystem function and attenuate downstream runoff, reduce the rate and magnitude of runoff during precipitation events, and lessen the need to store runoff in large reservoirs.

Methodology:

The State should develop requirements for updating relevant land use plans in upper watersheds to protect and increase the area of wetlands and pass legislation governing subdivisions standards. Plans should be updated to increase vegetative cover, expand wetland areas, install drywells to convert surface runoff to groundwater recharge, "daylighting" concrete lined or culverted drainage channels, and minimize the area of compacted or impermeable surfaces. Local watershed projects to increase soil permeability, increase vegetative cover, increase the area of wetlands , and increase the connectivity between stream channels and floodplains should be supported with technical assistance and funding. Work with land management agencies and local planning agencies in watersheds to reduce the extent of compacted or impermeable surface, reduce the likelihood of catastrophic wildfires and increase overall vegetative cover. This will increase percolation and water retention rates across broader areas and reduce the need for more expensive downstream options. The State may also be able to provide funding to local jurisdictions to accomplish these actions.

CVFPP Goals

Contributes Significantly to: Promote Ecosystem Functions

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☑ Improve Operation and Maintenance
- ☑ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☑ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained for further evaluation.

Advantages:

- Will work well in conjunction with other MAs involving setback levees
- Provides environmental, flood risk reduction, recreation, and water quality benefits.
- Reducing runoff results in erosion reduction and reduction of sediment transport.
- Reduces the peak stormwater runoff and decreases the frequency and consequences of flooding.

Disadvantages:

- May reduce potential tax bases of local jurisdictions by limiting development.

Economic Considerations:

Capital Cost? (High, Medium, Low)

The costs to modify the policy would be relatively low. However, capital costs associated with implementation of the policy would be relatively high to the extent physical construction. Setback levees, groundwater recharge areas, drywells, and wetland creation all carry a cost and the cost can be high if done on a large scale. Some of this cost could be shifted to developers responsible for urbanization. Preservation of upper watershed may involve substantial right of way costs for easement agreements and protracted negotiation with landowners, water right holders, and reservoir operators.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Improved upper watershed management will reduce the total and peak volume of stormwater discharged to the flood system and associated accelerated erosion and decrease the annual cost for operations/maintenance/repair.

Potential for Cost-Sharing?

Potential cost-sharing with local land use planning agencies for general plan modifications and private developers for project development and implementation.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Reducing peak stormwater runoff reduces the frequency and consequences of flooding; thereby reduces long-term costs of emergency response and recovery.

Flood fighting? (Increase, Decrease, or No Significant Change)

Reducing peak stormwater runoff reduces the frequency of flooding; thereby reduces long-term costs of floodfighting. There could also be some reduction in flooding in the upper watershed.

Effect on Damage to Critical Public Infrastructure?

Potential to reduce damage to critical public infrastructure by reducing the frequency and magnitude of flooding.

Effect on Floodplain and Economic Development?

Revised land use plans may inhibit future floodplain development.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Reduces the frequency of flooding; thereby reduces State flood responsibility.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

Upper watershed land management to reduce runoff by reducing impermeable surfaces and revegetation and stream channel and wetland restoration would rehabilitate key hydrologic processes in downstream areas by establishing a more natural hydrograph with attenuating peak flows, recharging groundwater, and increasing the growing season, in addition to the upper watershed habitat benefits.

Adverse Environmental Impact?

None for the policy change, but the physical construction of wetland areas, drywells, setback levees, etc. could have some impact.

Permitting Considerations?

None for changing the policy, but implementation of the policy would require permitting which could be minor to substantial depending on the project that was implemented.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

Minimal. The improvement of upland watersheds would likely result in a reduction in sediment loads will reduce the impacts associated with downstream flood maintenance.

Social Considerations:

Public Safety?

Improves public safety by reducing the frequency and magnitude of flooding. In addition it will reduce the maintenance on downstream channels and facilities along the valley floor.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to enhance recreation and open space values. Potential for water supply benefits by increasing infiltration to groundwater. Delayed groundwater recharge of streams may help maintain instream flows and critical water temperatures for over summering salmonids. Improvement of aquatic and upland habitats within the watershed.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Likely acceptable at the State level; local implementation may face challenges as implementation would restrict development.

Technical Considerations:

Redirected Hydraulic Impacts?

None. This MA may reduce the total and peak volume of water and sediment discharged to the flood system.

Residual Risk?

This MA reduces peak stormwater runoff, decreasing the frequency and consequences of flooding.

Climate Change Adaptability:

Implementation of the policy created by this action would enhance hydrologic adaptability by reducing the magnitude of potential flood flows, and thus reducing flood risk and moderating potential damage; this enhancement of hydrologic adaptability would also enhance biological adaptability by increasing the amount and complexity of habitat and its continuity along environmental gradients, and by reducing the consequences of extreme events. Additionally, carbon sequestration could increase with wetland creation.

Urban, Small Community, and Non-Urban Considerations:

Potential significant impacts to small and non-urban communities adjacent to or located within the upper watershed. May take education to acquaint small community decision-makers with the benefits to elicit their cooperation and support for implementation. Potential for rural areas to become more involved in watershed restoration improvement and develop a new community esprit de corps identity.

Regional Applicability:

The entire Sacramento and San Joaquin River upper watershed drainages would apply. Not the Delta.

Integration with Other Programs:

Integrated Regional Water Management Program

References:

USACE 2001 Sacramento and San Joaquin River Basins Comprehensive Study;RCR; Feather River Coordinated Resource Management (CRM) Group; Cosumnes American Bear Yuba Integrated Regional Water Management Plan

DRAFT Management Action Evaluation

Management Action Title: MA-040

Improve quality and quantity of wetland habitat within the flood system.

Description:

Problem:

Within the flood system, in reaches with levees, wetlands are confined to a narrow, intermittent fringe, separated by large reaches with limited or only low-quality habitats. Seasonal wetlands are lacking within the lower Sacramento River Basin (with the exceptions of the Yolo and Sutter bypasses and lower Cosumnes River) and are largely absent in the San Joaquin River Basin. Trees, root mats, and other wetland vegetation slow the speed of flood waters and distribute them more slowly over the floodplain. This combined water storage and braking action lowers flood heights and reduces erosion. Wetlands within and downstream of urban areas are particularly valuable, counteracting the greatly increased rate and volume of surface- water runoff from pavement and buildings. The holding capacity of wetlands helps control floods and prevents water logging of crops. Preserving and restoring wetlands, together with other water retention, can often provide the level of flood control otherwise provided by expensive dredge operations and levees.

Desired Outcome:

Increase in the quantity and quality of wetland habitat within the flood system without sacrificing the operability and maintenance of the flood protection works or increase flood risks.

Methodology:

Identify and evaluate areas for potential wetland habitat improvements. The bypass system of the lower Sacramento River offers extensive opportunity of wetland habitat improvements. Develop regional flood system mitigation banks which enhance the quantity and connectivity of wetland habitat. Redesign the flood system to allow for creation and/or connectivity of wetland habitats.

CVFPP Goals

Contributes Significantly to: Promote Ecosystem Functions

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☑ Improve Operation and Maintenance
- ☑ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☑ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained for further evaluation.

Advantages:

- Will work well in conjunction with MAs involving setback levees and land use planning.
- Provides ecosystem restoration, and water quality benefits.
- Provide potential mitigation credits to offset O&M and flood project impacts.

Disadvantages:

- Potential for wetland habitat improvements may be limited in areas with extensive urban floodplain development.
- May restrict operation and maintenance.
- Depending on type and location of wetland creation methylation of mercury could be a problem.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Medium. Capital costs associated with enhancing wetlands include costs for permitting, design, and construction of wetlands.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Increased monitoring and maintenance of restored wetlands may moderately increase the annual cost to

operate/maintain/repair the flood system. However, wetlands can detain floodwaters and attenuate flood peaks, potentially easing strain on downstream flood protection structures.

Potential for Cost-Sharing?

Potential for cost-sharing with Federal, State, local, and non-governmental agencies interested in habitat restoration, as well as with levee-maintaining agencies in need to offset maintenance impacts.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

This MA may decrease emergency response and recovery costs by detaining floodwaters in wetlands and attenuating flood peaks downstream.

Flood fighting? (Increase, Decrease, or No Significant Change)

This MA may decrease flood fighting costs by detaining floodwaters in wetlands and attenuating flood peaks downstream.

Effect on Damage to Critical Public Infrastructure?

Any linkage would be location specific and therefore unpredictable if the location is not known.

Effect on Floodplain and Economic Development?

No direct effects; if wetland creation is part of advance mitigation planning it may facilitate floodplain development elsewhere within the flood system by streamlining mitigation processes.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential to reduce State flood responsibility by attenuating flood peaks downstream of wetlands and reducing the frequency of flooding.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

Increase wetland area in the flood system could rehabilitate key physical processes and would rehabilitate ecological functions, by improving water quality and providing additional habitat.

Adverse Environmental Impact?

Possibility of mercury methylation depending on the location and type of wetland creation. Potential for impacts to cultural resources.

Permitting Considerations?

Substantial but less complex

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

Habitats that have been affected by flood system O&M would be rehabilitated. Provide potential mitigation credits to offset O&M impacts.

Social Considerations:

Public Safety?

Potential to improve public safety by attenuating flood peaks downstream of wetlands and reducing the frequency of flooding.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to enhance recreation and open space values. Potential for water supply benefits by detention of flood water and natural contaminant filtering. Creation/enhancement of "Wildlife Areas" can have recreation benefits including trails, hunting, and/or wildlife viewing.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Likely to be politically and institutionally acceptable, especially within the existing Sacramento River bypass system. May be more difficult in areas with extensive floodplain development. Additionally, wetland development projects have to compete

for scarce financial resources, so implementation may be slow due to tight budgets.

Technical Considerations:

Redirected Hydraulic Impacts?

Increasing wetland areas will reduce the velocity of flood waters.

Residual Risk?

May reduce residual risk downstream by attenuating flood peaks.

Climate Change Adaptability:

This action would increase biological adaptability by increasing the amount and connectivity of and range of environmental conditions within wetland habitats, and thus, increasing the ability of these habitats to adjust to climate change, and to persist through and recover from extreme events. In addition, wetland creation could ameliorate peak runoff events.

Urban, Small Community, and Non-Urban Considerations:

May be limited potential for wetland habitat improvements in urban areas with extensive floodplain development. However, wetland creation in urban areas may be more critical than in more rural areas, because urban areas typically have lost the greatest percentage of their pre-existing wetlands. Wetland creation in rural areas may be more accepted with cooperative efforts to use coalition building techniques to enhance and restore a board landownership base.

Regional Applicability:

All regions

Integration with Other Programs:

Central Valley Conservation Strategy (FESSRO), Corridor Management Strategy (FMO), Interagency Flood Management Collaborative Program, Fish Passage Improvement Program (FESSRO), Integrated Regional Water Management Program Flood Protection Corridor Program (FPO), Urban Streams Restoration Program (FESSRO) Ecosystem Restoration, other conservation agencies and conservation oriented nonprofit organizations with ongoing wetland programs.

References:

Delta Risk Management Strategy; U.S. Environmental Protection Agency. 1995b. America's wetlands: Our vital link between land and water. Office of Water, Office of Wetlands, Oceans and Watersheds. EPA843-K-95-001. Wetlands: Protecting Life and Property from Flooding; Executive Order 11988: Floodplain Management - an order given by President Carter in 1977 to avoid the adverse impacts associated with the occupancy and modification of floodplains. Cosumnes River Preserve:http://www.cosumnes.org/index.html

DRAFT Management Action Evaluation

Management Action Title: MA-041

Improve quality and quantity of riparian habitat in the flood system.

Description:

Problem:

There has been a loss, fragmentation, and degradation of native riparian habitat within the flood management system and its associated floodplains.

Desired Outcome:

Increased riparian habitat quality, quantity, diversity and connectivity that contributes to a more sustainable flood management system, without compromising flood system function or public safety.

Methodology:

Identify important riparian habitat types and ecosystem processes that need improvements in management, enhancement, and restoration. Identify effective approaches to improve habitat and ecosystem processes that also benefit a variety of important species. Identify candidate areas that are most suitable for improving habitat and meeting other CVFPP goals. Identify opportunities to increase or improve habitat as part of other flood projects and operations. For example, such opportunities exist where levees are currently set back from the low-flow channels of rivers (such as along reaches of the Feather, Yuba, Sacramento, and American rivers, and in the Delta). Opportunities may also exist to create new floodplain habitat, establish habitat within existing or new floodways, or establish habitat on or alongside berms or other engineered features. Increase the quality, quantity, diversity and connectivity of vegetation and habitat within and adjacent to the existing flood management system, with a focus on native riparian, floodplain, and shaded aquatic habitats. Habitat should be established as part of flood facilities (levees, bypasses, channels, etc) in ways that contribute to the long-term, sustainable operation and maintenance of the flood management system, while not compromising the ability to pass design flows. Evaluate hydraulic capacities of bypasses on two-dimensional basis to identify flow constrictions and opportunities for improving habitat.

CVFPP Goals

Contributes Significantly to: Promote Ecosystem Functions

Potentially Contributes to (Check all that apply):

- ☐ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☑ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☑ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained for further evaluation; look for opportunities to combine with management actions involving maintenance, setback levees, and floodplain storage. More research by UC Davis at the large flume at the J. Amorocho Hydraulics Laboratory could resolve various vegetation issues in regards to species impact on flood flows in the central valley rivers.

Advantages:

- Will work well in conjunction with other MAs involving setback levees.
- May improve bank stability.
- Will help offset climate change effects of CO2 in the atmosphere.
- Potential to offset impacts to maintenance activities.
- Riparian vegetation within flood control systems can be designed to have no impact on the flood flows, but to

Disadvantages:

- If timely and appropriate maintenance is not performed, may have upstream hydraulic impacts due to reduced channel capacity.
- Timing of channel maintenance could be limited due to species issues.
- Vegetation could contribute large woody debris downstream that could be a hazard to boater safety.

positively improve the stability of the levees by limiting erosion, absorbing turbulence, increase wildlife habitat, restore native plants communities in the floodways.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Revegetation projects would likely require a low to medium level of initial investment.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Initially during the establishment period, costs could be increased and would include monitoring of the site. Once established, habitat maintenance costs are generally low (primarily invasive species control) . Annual O&M and repair costs for flood facilities with increased habitat will vary, depending on the site specific situation. Currently unvegetated facilities may require increased costs for managing vegetation consistent with flood risk reduction goals. In other cases increased vegetative cover may improve bank stability and , reduce erosion rates, reducing the and lower repair costs. Increased vegetation throughout the flood system may reduce the volume of sediment deposited downstream and the needand lower costs for dredging.

Potential for Cost-Sharing?

High potential for cost-sharing with other state, federal, and local agencies and programs for revegetation projects. Potential to leverage local volunteer labor for projects.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

As vegetation enhancements would be constrained by the requirement to not compromise design flows, there would likely be no significant change in costs for emergency response and recovery. However, increasing the extent of vegetation in locations with setback levees may decrease the level of protection of the levees and may have some upstream hydraulic impacts. These impacts are likely to be minor due to the siting of the setback levees. Vegetation can also protect levees from erosion due to wave wash and scouring, so can protect levee integrity.

Flood fighting? (Increase, Decrease, or No Significant Change)

As vegetation enhancements would be constrained by the requirement to not compromise design flows, obstruct visibility or interfere with flood fighting, there would likely be no significant change in floodfighting costs. However, increasing the extent of vegetation in locations with setback levees may decrease the level of protection of the levees and may have some upstream hydraulic impacts. These impacts are likely to be minor due to the siting of the setback levees.

Effect on Damage to Critical Public Infrastructure?

Region specific

Effect on Floodplain and Economic Development?

Enhancing vegetation in floodplains will not increase floodplain development as these areas are not appropriate for development. Vegetation enhancement will benefit the wildlife habitat and recreation opportunities in the region, which may be an economic benefit to the local community.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

As vegetation enhancements would be constrained by the requirement to not compromise design flows, there would likely be no significant change in State Flood Responsibility. Establishment of habitats must be coupled with the ability to maintain them for public safety without incurring additional mitigation costs.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

Increasing the areal extent of vegetation in floodplains will rehabilitate key physical processes and ecological functions. It will enhance riparian and wetland habitats and processes, as well as stabilize banks.

Adverse Environmental Impact?

None. Revegetation of floodplains will have a beneficial environmental impact.

Permitting Considerations?

Could be minor to substantial but streamlined, depending on the extent and nature of habitat projects. These may include NEPA, CEQA, CDFG stream alteration permits, CWA 401, 402, and 404 permits, for example, if construction activities affect aquatic environments. Opposition to revegetation by those who view it as negatively affecting flood flows could delay the permitting process.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

Habitat improvement projects can provide mitigation opportunities for habitat losses elsewhere in the FM system. if coupled with long-term agreement for operation and maintenance, revegetation can stabilize banks and reduce downstream sediment yield, reducing the need for dredging operations.

Social Considerations:

Public Safety?

As vegetation enhancements would be constrained by the requirement to not compromise design flows and to allow for future maintenance, there would likely be no significant change in public safety impacts.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Habitat improvement projects can provide opportunities for recharging ground water, stabilizing banks and reducing downstream sediment yield. Increased vegetation may enhance aesthetic, recreational, and open space values within floodplains and increase recreational opportunities (e.g. trails, hunting, fishing, waterway access). Reconnecting rivers to floodplains in low-risk areas provides an opportunity to improve water quality in a long-term sustainable way at relatively low costs. Active flood plains and associated wetlands can temporarily store floodwaters, filter nutrients and impurities from runoff, process organic wastes, capture high sediment loads outside of the main flood channel, and moderate water temperature fluctuations.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Establishing additional vegetation in the flood system is still controversial, but well-designed projects to restore habitat along major rivers (e.g., O'Connor Lakes restoration project and Abbott Vegetation Restoration on the Feather River) are supported by many sectors, including natural resource agencies, infrastructure agencies, environmental organizations, and recreational interests. However, these projects have to compete for scarce financial resources, so implementation may be slow due to funding limitations.

Technical Considerations:

Redirected Hydraulic Impacts?

As vegetation enhancements would be constrained by the requirement to not compromise design flows, there would likely be no significant change in upstream hydraulic impacts. Potential increase in large woody debris in channel downstream if timely and appropriate maintenance is not performed.

Residual Risk?

As vegetation enhancements would be constrained by the requirement to not compromise design flows, there would likely be no significant change in residual risk. Potential increase in large woody debris in channel downstream if timely and appropriate maintenance is not performed. Long term maintenance standards and funding should be established as much as possible at the time of project implementation to avoid issues with future maintenance.

Climate Change Adaptability:

This action would enhance biological adaptability by increasing habitat quantity, connectivity, complexity, and continuity across environmental gradients; and thus, increasing the size and viability of populations, and their ability to handle and adjust to the consequences of climate change. An increase in vegetation will help offset climate change by removing CO2 from the atmosphere.

Urban, Small Community, and Non-Urban Considerations:

Local opposition to vegetation restorations from the common belief that all riparian vegetation growing within the channel is a

problem, because of fears that the vegetation will slow or re-direct the flows.

Regional Applicability:

All regions

Integration with Other Programs:

Central Valley Conservation Strategy (FESSRO), Corridor Management Strategy (FMO), Interagency Flood Management Collaborative Program, Flood Corridor Program (Projects Office), Natural Community Conservation Plans and Habitat Conservation Plans (several), Riparian Habitat Joint Venture, Central Valley Habitat Joint Venture, species recovery plans, other conservation agencies and non-profits.

References:

USACE 2001 Sacramento and San Joaquin River Basins Comprehensive Study;RCR; http://www.riverpartners.org/riparian-ecology/veg-floodway/the-flume.html;http://www.cosumnes.org/index.html, http://cabyregion.org/; http://cherokeewatershed.org/index.php; http://www.feather-river-crm.org/

DRAFT Management Action Evaluation

Management Action Title: MA-042

Improve natural riverine processes by removing un-natural hard points along channels

Description:

Problem:

Unnatural hard points - such as bridge abutments, rock revetment, dikes, or other physical encroachments into a channel or waterway can affect the hydraulics of river channels, constraining dynamic natural fluvial geomorphologic processes of erosion, deposition, and channel meander that contribute to healthy and sustainable ecosystems.

Desired Outcome:

Promote natural physical processes that support essential ecosystem functions within the flood management system.

Methodology:

Changing the physical features of the conveyance system by removing hard points, such as rock revetment, dikes, or other structures in the river, can improve ecosystem functions by promoting natural erosion and deposition processes, aquatic and terrestrial habitat heterogeneity, and successional habitat development. However, removing hard points must be commensurate with replacement of a feature that affords like function (e.g., level of protection, water management, vehicular passage), and must not restrict operability or maintainability of the flood protection works. Riparian, wetland, shallow water, and terrestrial habitats could be integrated into this measure in ways that do not reduce flood flow capacity. In some cases, removal, modification, or relocation of hard points can also contribute to flood damage reduction by reducing constrictions or improving channel capacity. This management action could also incorporate vegetation types or features that improve or facilitate operation and maintenance of the flood management system.

CVFPP Goals

Contributes Significantly to: Promote Ecosystem Functions

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☑ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☐ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retain for future evaluation after systemic problems have been resolved.

Advantages:

- Improves natural geomorphologic processes (deposition, erosion, meander).
- Supports self-sustaining ecosystem functions (transitional or successional habitat).
- Potential to reduce flood risk if coordinated with actions that remove channel constrictions and improve conveyance.
- When incorporated with riparian forest restoration, bank erosion provides the process to directly incorporate large woody habitat into the aquatic environment.

Disadvantages:

- Would need to be implemented in ways that do not impact levee or flood system integrity (erosion, meander).
- Potential loss of Federal cost-sharing for bank protection and PL 84-99 accreditation if implementation cannot be shown to maintain existing level of protection.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Medium to High initial investment depending on number, location, and types of hard points and treatments implemented. Low, where the end result can be accomplished by simply eliminating maintenance and repair.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Unable to determine at this time; potential to increase maintenance and repair costs if leads to significant erosion on or near flood management facilities; although, implementation of this management action is unlikely under those circumstances . Alternately, could reduce maintenance and repair costs over time if erosion and other factors are considered and accounted for as part of implementation. Also, will represent a significant cost savings where bank revetment has no direct affect on flood risk reduction.

Potential for Cost-Sharing?

Potential for Federal cost sharing via contributions to existing Federal project purposes (environmental restoration). Additional cost-sharing must be commensurate with potential loss of existing Federal cost-sharing for bank protection (Sac Bank).

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Will eliminate costs of response and repair where revetment is no longer maintained, but must not jeopardize PL 84-99 eligibility.

Flood fighting? (Increase, Decrease, or No Significant Change)

Encroachments may obstruct visibility or restrict the use of some flood fighting method.

Effect on Damage to Critical Public Infrastructure?

Cannot determine at this time (site specific)

Effect on Floodplain and Economic Development?

No direct effects

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential increase in liability if not combined with actions to reduce flood conveyance constrictions and strengthening of levees. Responsibility will be reduced by removing maintenance and repair of bank revetment that does directly contribute to reducing flood risk.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

Reducing flow constrictions and hard points would rehabilitate physical processes, including sediment transport and channel forming processes, and would improve aquatic and riparian habitat as a result of enhancing physical processes (particularly if habitat is incorporated into action).

Adverse Environmental Impact?

Potential construction impacts (temporary or permanent) associated with physical removal of hard points; however, these impacts would be offset by long-term environmental benefits of the action.

Permitting Considerations?

Substantial, but streamlined.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

Habitats that have been affected by flood system construction and O&M would be rehabilitated to the extent possible considering the need for future maintenance.

Social Considerations:

Public Safety?

Potential to improve public safety if combined with actions to reduce flood flow constrictions (increase flood system capacity) and address erosion of flood management features. Potential to decrease public safety if commensurate level of protection cannot be achieved, continued maintenance is not possible, and PL 84-99 accreditation is lost.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Would improve and/or provide aesthetics, recreation, natural riparian vegetation, and salmon rearing and bank swallow nesting habitat.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Removal of hard points has been advocated by local governmental bodies and landowners who share in the cost and responsibility of maintaining revetment that does not reduce flood risk.

Technical Considerations:

Redirected Hydraulic Impacts?

If removal of hard points increases channel capacity, could result in hydraulic impacts downstream

Residual Risk?

Potential to impact downstream conveyance capacity and weaken existing levees increasing overall flood risks.

Climate Change Adaptability:

Restoring wetlands to a more natural state will enhance their adaptability to climate change.

Urban, Small Community, and Non-Urban Considerations:

Potential loss of federal cost-sharing for bank protection.

Regional Applicability:

Potentially applicable in all regions where hard points exist; removal of hard points may not be suitable in areas where levees are subject to significant erosion/scour

Integration with Other Programs:

Central Valley Conservation Strategy (FESSRO), Corridor Management Strategy (FMO), Interagency Flood Management Collaborative Program

References:

USACE 2001 Sacramento and San Joaquin River Basins Comprehensive Study;

DRAFT Management Action Evaluation

Management Action Title: MA-043

Develop hazardous waste and materials management protocols to identify, contain and remediate potential water quality hazards within floodplains.

Description:

Problem:

Flooding can impair water quality through the mobilization of hazardous materials or contaminants on floodplains. These materials or contaminants may originate from mines, feed lots, fuel tanks, septic systems, landfills, illegal dumping, or other sources. In addition, flooding events following prolonged droughts may result in, increased water quality impacts from pollutants in the watershed being carried by the runoff. Also, increased runoff during the flood season that temporarily inundates floodways in areas know to have high levels of mercury may also impact water quality by increasing methylmercury levels .

Desired Outcome:

Protocols should be developed to manage hazardous waste and materials in the floodplain. Hazardous materials should be identified, contained and remediation conducted, if necessary.

Methodology:

Coordinate with Regional Water Quality Control Boards to develop protocols outlining ways to identify, contain, and remediate potential water quality hazards prior to a flood event. A protocol should be developed to safely use, reuse, and treat sediment contaminated with hazardous materials, including methylmercury. Additional research will need to be conducted to identify potential water quality hazards. Containment and remediation will be dependent upon the type and location of hazards found

CVFPP Goals

Contributes Significantly to: Promote Ecosystem Functions

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☑ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☑ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retain for future evaluation after systemic problems have been resolved.

Advantages:

- Works in conjunction with other actions that increase river connection to floodplains.
- Promotes multiple benefits including ecosystem services, water supply, and public safety.

Disadvantages:

- Does not directly reduce the risk of flooding.
- Costs for hazardous waste removal could be high.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Policy MAs will have a substantially lower capital cost than other MAs which involve structural modifications. Example of capital investments include: Funding for planning activities; Funding for communication system upgrades, etc. Some testing/monitoring may be required for protocol/plan development. Potential for increase in up-front capital cost if areas known to have hazardous materials (including methylmercury) are treated or cleaned prior to flood event. The cost to contain and remediate hazardous materials could be substantial, depending on the type and location of materials.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Development of the new protocols will lead to no significant change in the annual cost to operate/maintain/repair the flood management system.

Potential for Cost-Sharing?

Potential for cost sharing with US EPA and CA DTSC. Additional potential for coordination with ongoing TMDL projects.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

No significant change in emergency response costs, but potential decrease in recovery costs due to reduced level of hazardous materials in sediment deposited by floodwaters.

Flood fighting? (Increase, Decrease, or No Significant Change)

This MA will not change the frequency of flooding and will have no significant effect on flood fighting costs.

Effect on Damage to Critical Public Infrastructure?

May reduce the concentration of hazardous materials in sediment deposited on infrastructure during flood events.

Effect on Floodplain and Economic Development?

This MA may result in land-use restrictions and restrictions on industrial activities within the floodplains .

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

By decreasing the potential for spread of contaminants from flooding, this MA would likely decrease state flood responsibility if responsibility for specific areas of known or potential sources of contamination can be identified prior to flood events.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

Would indirectly contribute to rehabilitation of key physical processes and ecological functions by developing protocols for known highly contaminated areas and cleaning up those areas. Once a protocol is approved and addressed, and the contamination is cleaned up, contamination as a direct result of flooding would be reduced. This could therefore increase use of floodplains and flood basins for flood management by reducing hazards and obstacles to the use of that land.

Adverse Environmental Impact?

None

Permitting Considerations?

There are no expected permitting considerations for the development of the protocols; however, permits would be required if remediation is necessary.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

This management action would inform levee maintaining agencies of potential for hazardous materials and provide protocols for addressing them. The information developed could be used to plan for O&M and repairs to the system.

Social Considerations:

Public Safety?

This MA would enhance public safety by reducing human health risks from hazardous materials mobilized by flooding.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

This MA would improve water supply by reducing the loading of contaminants; reducing contaminants could also improve recreational opportunities within the system

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Existing programs to reduce contaminant loading to rivers have publicized this issue, improving its probability of political and institutional acceptance. However, there is potential for political concerns if protocols affect existing industries operating on floodplains.

Technical Considerations:

Redirected Hydraulic Impacts?

None

Residual Risk?

N/A

Climate Change Adaptability:

This action would enhance biological adaptability by reducing an adverse effect of larger flood events on water quality and aquatic and riparian species. - Protocols addressing mercury methylation could provide decision makers with tools to adapt to the changing inundation regimes that may result from climate change.

Urban, Small Community, and Non-Urban Considerations:

No specific considerations identified.

Regional Applicability:

All regions

Integration with Other Programs:

References:

RCR;

DRAFT Management Action Evaluation

Management Action Title: MA-044

Reoperate flood-control reservoirs to more closely approximate natural flow regimes.

Description:

Problem:

Reservoir operators manage storage and releases for many competing uses. By altering flow regimes, the same dam that attenuates flood peaks and protects public safety also alters downstream hydrologic processes in ways that may be incompatible with supporting viable ecosystems within the system streams. Current operations may reduce habitat complexity, limit habitat access for aquatic and terrestrial species, and alter the in-stream flow regimes necessary to sustain floodplain and riparian habitat. By reducing seasonal flow fluctuations, system reservoirs can contribute to channel aggradation (thus, reducing channel capacities), the establishment of invasive species, and also restrict the availability of habitat necessary for species survival (i.e., the absence of seasonal flows that would, under natural conditions, flush fine sediment and redistribute bed sediment that is used by spawning anadromous species).

Desired Outcome:

Re-operate reservoirs on a short-term, periodic basis to support ecosystem needs while also protecting water supplies and allowing adequate reservoir storage space for flood management.

Methodology:

Coordinate with ecosystem managers to discern ways in which ecosystem processes can be better supported by non-emergency reservoir operations, while still managing storage space for necessary water supply and flood management. The releases should optimize the duration and timing of flows needed to sustain viable ecosystems and the inundation of floodplain habitat currently connected to streams within the flood system. Changes in releases must also accommodate necessary flood maintenance requirements. Channel maintenance may benefit from flushing flows, which could assist with vegetation management and snag removal, while also serving ecosystem needs. Although this action addresses non-flood operation of reservoirs, it supports an overarching goal of the CVFPP to manage the flood system for multiple benefits.

CVFPP Goals

Contributes Significantly to: Promote Ecosystem Functions

Potentially Contributes to (Check all that apply):

- ☐ Improve Flood Risk Management
- ☑ Improve Operation and Maintenance
- ☑ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☐ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retain for further evaluation

Advantages:

- Will work well in conjunction with other MAs involving floodplain reconnection, instream habitat, conjunctive management, and wetland creation.

Disadvantages:

- May be politically/institutionally difficult to implement.
- May affect long-term water supply reliability.
- May affect recreational opportunities at reservoirs and river downstream.
- May increase FMO's maintenance responsibilities.
- May increase downstream flooding.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Medium. Capital costs associated with modifying dam outlet features or constructing auxiliary spillways.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

This MA may decrease hydropower benefits, increase the net annual cost to operate/maintain/repair.

Potential for Cost-Sharing?

Potential for cost sharing with federal dam operators.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

No significant change in emergency response and recovery costs, as reoperation would likely be constrained to avoid increasing the frequency of flooding.

Flood fighting? (Increase, Decrease, or No Significant Change)

No significant change in flood fighting costs, as reoperation would likely be constrained to avoid increasing the frequency of flooding.

Effect on Damage to Critical Public Infrastructure?

No significant effect on damage to critical public infrastructure, as reoperation would likely be constrained to avoid increasing the frequency of flooding.

Effect on Floodplain and Economic Development?

The increased flows would not be flooding flows and thus unlikely to significantly affect floodplain development.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

No significant effect on State flood responsibility, as reoperation would likely be constrained to avoid increasing the frequency of flooding.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

Re-operating flood control reservoirs to more closely approximate natural flow regimes would rehabilitate key physical processes and ecosystem functions, by reducing scour and deposition of sediment, by providing appropriate flows for fish migration, rearing and spawning, and by providing opportunities for establishment of native riparian tree species such as cottonwoods and willows.

Adverse Environmental Impact?

None

Permitting Considerations?

Permits for reoperation would be substantial but less complex. Permitting with FERC would be required. As as result of this MA, permitting for maintenance actions could become more complicated.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

No significant change to public safety, as reoperation would likely be constrained to avoid increasing the frequency of flooding.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to provide recreation and fisheries benefits by changing the flow regime. Potential for avian benefits as well as preserved open space. Potential for fish and wildlife enhancement.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

May face political and institutional opposition, as existing release patterns provide hydropower and water supply benefits to

current users of the system. Re-operation will also need to show it will not hydraulically impact the flood flow regime or increase risks.

Technical Considerations:

Redirected Hydraulic Impacts?

Will alter flow patterns downstream of dams.

Residual Risk?

No significant change to residual risk, as reoperation would likely be constrained to avoid increasing the frequency of flooding.

Climate Change Adaptability:

This action would increase biological adaptability by increasing habitat complexity, connectivity, and continuity along environmental gradients; and thus, increasing the ability of species to handle and adjust to the consequences of climate change (e.g., extreme events). However, more preciptation in the form of water may force larger releases in the rainy season.

Urban, Small Community, and Non-Urban Considerations:

No specific considerations identified

Regional Applicability:

Not directly applicable in Delta Region, but may be used to improve fisheries and habitat in the Delta. Changes in flow could change position of X2. Strict salinity standards currently exist in the Delta if greater variations in flows were managed for this could help prevent establishment of invasive species in the Delta and enhance native species.

Integration with Other Programs:

Reservoir reoperation studies (HAFOO, future program), Forecast-Coordinated Operations Program (HAFOO) including the Yuba-Feather Forecast-coordinated Operationis Program, Forecast-Based Operations Program and FMO

References:

USACE 2001 Sacramento and San Joaquin River Basins Comprehensive Study;

DRAFT Management Action Evaluation

Management Action Title: MA-045

Reduce the incidence of invasive species in the flood management system.

Description:

Problem:

Invasive species have spread through the flood management system, causing problems for both ecosystems and flood management. The past and continuing introduction of aquatic, riparian, and upland invasive species can reduce the effectiveness of flood management facilities by 1) decreasing the channel capacity; 2) increasing rate of sedimentation; and 3) increasing maintenance costs. Non-native, invasive plant species that are especially detrimental to native ecosystems are widespread within the study area where they often out-compete native plants for light, space, and nutrients, further degrading habitat quality for native fish and wildlife. Introductions of nonnative and invasive species have contributed to a decline in the number and function of native wildlife and plant communities (Cohen and Carlton, 1998). The Central Valley and Delta now contain an unknown number of nonnative species, and a new species (many of which are aquatic invertebrates) is estimated to be introduced at least every 14 weeks (Cohen and Carlton, 1998).

Desired Outcome:

Effective control of invasive species in the flood management system. Modification of regulations to avoid using non-native plants for revegetation efforts within the flood system. Best management practices should be instituted for the treatment and control of wide-spread non-native invasive plant species populations within the flood management system.

Methodology:

Revise and update regulatory standards (Section 131 of the California Code of Regulations Title 23 Division 1 Chapter 1 Article 8) to prohibit introduction of non-native species in the flood management system. Locate and map invasive species in flood management system. Establish long-termed agreement for effective control of invasive species that includes the use of mechanized equipment and herbicide while conducting investigation for means of eradicating invasive species and prevent their future introduction. Avoid the use of invasive non-native plants in revegetation efforts. Remove these species from approved lists in the current CVFPB flood system regulatory standards (Article 8, ss 131). Locations of the invasive giant reed (Arundo donax); saltcedar (Tamarix ramosissima); purple loosestrife (Lythrum salicaria);tree of heaven (Ailanthus altissima); scarlet wisteria (Sesbania punicea); parrot feather (Myriophyllum aquaticum); Himalyan blackberry (Rubus discolor); aquatic primrose (Ludwigia peploides); yellow starthistle (Centaurea solstitialis); Spanish broom (Spartiurn junceum); French broom (Genista monspessulana); Scotch broom (Cytisus scoparius); skeleton weed (Chondrilla juncea) and other non-native invasive plant species in and adjacent to water channels should be mapped and eradicated or otherwise treated and controlled using best management practices.

CVFPP Goals

Contributes Significantly to: Promote Ecosystem Functions

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☑ Promote Ecosystem Functions
- ☑ Improve Institutional Support
- ☐ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained for further evaluation.

Advantages:

- Will work well in conjunction with other MAs involving ecosystem restoration and channel maintenance.
- May provide potential mitigation credit to offset impacts

Disadvantages:

- May have a minor downstream hydraulic impacts due to increased upstream channel capacity.
- May take 5 years or more to materialize the benefit.

from maintenance.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Medium. Lower cost relative to structural improvements, but potential costs related to permitting, maintenance, mapping, and technical evaluation on how to eradicate invasive species from the flood management system.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Increase in the annual maintenance budget will be needed to control the spread of invasive species. Additional funding will also be needed to develop channel specific management plans and evaluate complete removal and prevention of future infestation of invasive species. In the long term, there may be initial increase funding needs for native species planting to reduce future invasive from returning.

Potential for Cost-Sharing?

Potential for cost sharing with other State and federal ecosystem restoration programs, local non-governmental organizations, and levee maintaining agencies.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Reducing the quantity of invasive plants within the flood system has the potential to increase channel capacity, and decrease the frequency of flooding. This would decrease emergency response and recovery costs.

Flood fighting? (Increase, Decrease, or No Significant Change)

Reducing the quantity of invasive plants within the flood system will provide responder greater visibility to monitor the channels and respond proactively to prevent flooding (levees that are not choked of vegetation allows for application of more flood fighting techniques). Reduced vegetation will also improve channel capacity decreasing the risk of flooding thereby decreasing potential costs associated with flood fighting.

Effect on Damage to Critical Public Infrastructure?

Region specific.

Effect on Floodplain and Economic Development?

Unlikely to have significant effect on floodplain development.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential to increase the State's responsibility because control and eradication needs to a component of the overall channel management plan that include areas or reaches outside of the State-federal flood protection works.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

Reducing the spread of invasive plants would rehabilitate key physical processes and key ecosystem functions, because some invasive plants obstruct flow and sediment transport, cause excessive channel and bank erosion, by deflecting current, and compete with native vegetation for light water and nutrients and provide no or less habitat value for native wildlife species. Active management of the channels to reduce obstructions to flow and improving the sediment transport will improve channel conveyance and minimize channel and bank erosions. Improvements on flood management system should include consideration of rehabilitation of key physical processes and ecosystem functions where feasible.

Adverse Environmental Impact?

None

Permitting Considerations?

Ongoing

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

The magnitude of adverse effects to habitats resulting from flood system O&M would be reduced.

Social Considerations:

Public Safety?

Increasing channel capacity by removing invasive plant species would reduce the frequency of flooding and improve public safety.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential for enhanced recreation, wildlife, and fisheries benefits.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Likely to be politically and institutionally acceptable.

Technical Considerations:

Redirected Hydraulic Impacts?

Potential to increase flow velocity, and/or increase capacity where invasive plants are removed.

Residual Risk?

Potential to increase channel capacity and reduce residual risk.

Climate Change Adaptability:

This action enhances biological adaptability by reducing the displacement of native vegetation, which both reduces a potential adverse consequence of climate change and enhances the ability of native species to handle and adjust to the consequences of climate change by reducing the loss of habitat and its continuity along environmental gradients. Restoring channels to a more natural state will enhance their adaptability to climate change.

Urban, Small Community, and Non-Urban Considerations:

No specific considerations identified at this time.

Regional Applicability:

All regions

Integration with Other Programs:

Central Valley Conservation Strategy (FESSRO), Channel Maintenance Program (PMO), Environmental Initiative Program (FMO)

References:

Environmental Sustainability Summary; Boyle & Associates, 2008. Madera County Integrated Regional Water Management Plan;

DRAFT Management Action Evaluation

Management Action Title: MA-046

Remove barriers to fish passage within the flood system.

Description:

Problem:

The single most major impact to California's native anadromous fish populations has been the construction of our major valley rim dams that are part of the flood and water supply systems in CA. The problem is that 80-90% of the historic spawning and rearing habitat has been made inaccessible to all fish for the last 50+ years. These dams were allowed to be built without the legally mandated fish passage facilities under DFG code of regulations, and hatcheries were supposed to offset the impact. Hatcheries have caused still continued declines in the salmon and steelhead genetics of the populations. Without future access to their historic upper watershed habitats these populations will continue in decline and especially when climate change effects will cause there to be less snow and more rain, reducing the amount of cold water available to release below these major dams. By not allowing fish upstream of these major facilities the water costs of maintaining cold water below the dams in the hotter valley floor will become impossible. Refer to modeling studies done by Surface Storage Investigations in DSIWM for results on water costs from warming climate conditions. Historic upstream habitats will be the only suitable habitat available that will not have future water costs as significant as the current operations of the major rim dams. Planning for future sustainability of water supplies and better flood operations at dams will require serious consideration of passing anadromous fish upstream of dams into the historic habitat remaining.

Desired Outcome:

Reduce the number of physical barriers to fish passage within the flood system without impacting the flood management system's ability to ensure public safety and limiting other water management strategies. This includes providing new passage past the major rim dams to provide access to remaining cold water spawning and rearing habitats upstream in the higher elevation watersheds. The flood control system dams will require physical modifications to provide volitional passage by fish moving up or downstream past these large dams. Improved water management options for water supply and flood release strategies further improving system sustainability and reliability in the face of climate change.

Methodology:

Identify physical barriers which inhibit fish passage within the flood system and acknowledge their significant contribution to the decline of the populations. Evaluate opportunities for enhancing fish passage through these obstructions, including installation of fish ladders or removal of the structures. Coordinate with existing fish passage removal programs with other State and Federal programs. Implement feasibility studies to assess and test ladder options and other ideas for passage around dams.

CVFPP Goals

Contributes Significantly to: Promote Ecosystem Functions

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☑ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☑ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained and developed further through Systems Re Operations feasibility studies; look for opportunities to combine with management actions involving setback levees and floodplain storage.

Advantages:

- Significant ecosystem benefits.
- Economic improvements, reduced regulatory restrictions

Disadvantages:

- High capital cost.
- Politically sensitive.

possible, more flexibility in water supply management, less flood management risks, significant improvements in fish use of available historic habitat resulting in improved populations over long term, improved climate change adaptability.	• Short-term construction cost during implementation. • Resistance from local landowners to ESA species in areas where they have not been in many years. • Impacts early rules implemented to protect upstream habitat and fish. • Removal of barriers may compromise a facility ability to provide adequate storage, or prevent it from meeting its design capacity. • Complex agreements needed for water management. • Complex and lengthy permitting process (and costly).

Economic Considerations:

Capital Cost? (High, Medium, Low)

Medium to High. Removal or modification of fish passage barriers may entail significant initial capital cost associated with demolition, construction, and restoration activities. Additionally, there will be costs associated with reoperation of water management for deliveries and usage that will require adoption of agreements from various parties (private, local, state and federal).

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

The removal of some barrier structures are unlikely to change annual cost to operate/maintain/repair. Many structures provide no flood control benefits, and their removal would not dramatically impact operations and maintenance of the flood system. However, flood management dams would require some new O&M for fish ladders or similar structures for fish passage. O&M would increase over current facilities O&M costs. These costs would be offset by water costs savings in delivery options and management flexibility and potential for less water delivery restrictions with increased fish populations and access to other beneficial habitat upstream of major dams.

Potential for Cost-Sharing?

Potential for cost-sharing with agencies with existing fish passage removal programs, such as the California Coastal Conservancy, the California Department of Fish and Game, CALFED, and NOAA Fisheries Services. Potential for cost-sharing with landowners impacted by erosion resulting from these barriers.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Potential to decrease emergency response and recovery costs. Potential to decrease frequency of flooding and improve level of protection upstream of barriers.

Flood fighting? (Increase, Decrease, or No Significant Change)

Likely no significant change to flood fighting costs, but unknown at this time.

Effect on Damage to Critical Public Infrastructure?

Region specific.

Effect on Floodplain and Economic Development?

Little to no effect on floodplain development. Potential to decrease frequency of flooding and improve level of protection upstream of barriers.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

No significant change in State flood responsibility, Potential to decrease frequency of flooding and improve level of protection upstream of barriers.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

Removing fish migration barriers would rehabilitate key ecological functions by enhancing salmonid migration and access to spawning habitat. Major economic and ecological benefits to the State and potentially economic interests beyond California

and the Central Valley.

Adverse Environmental Impact?

None

Permitting Considerations?

Substantial but less complex

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

The magnitude of adverse effects to habitats resulting from flood system O&M would be reduced. Significant savings to O&M environmental obligations with recovery of endangered species fish populations

Social Considerations:

Public Safety?

Potential to improve public safety by reducing flooding upstream of barriers. May provide improved options for flood management strategies.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to provide recreational fisheries benefits. Major water supply and economic benefits could be realized by implementing passage at major dams through improve water supply reliability, improved ecosystem functions and habitat conditions, and improved conditions for commercial and recreational salmon fishing industry

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Removal or modification of smaller fish passage barriers is likely to be more politically and institutionally acceptable than removal of larger barriers such as large flood control and water supply dams and weirs may face stronger political and institutional resistance.

Technical Considerations:

Redirected Hydraulic Impacts?

Removal of barriers could result in a reduced upstream flooding; increased velocities and sediment loads downstream of barriers. Better flood and water supply management flexibility through the years. Installation of fish ladders would result in no significant redirected hydraulic impacts.

Residual Risk?

Reduces residual risk to existing development upstream from barriers.

Climate Change Adaptability:

This action would increase biological adaptability by increasing the amount, connectivity, and variety of habitat available to fish species, and thus, increasing the size of fish populations and their ability to handle and adjust to the consequences of climate change. Allowing salmon and other fish access to upper watersheds above current barriers may become an essential management action as conditions on the valley floor deteriorate. This is the only major opportunity to provide significant adaptation strategies at major dams that will allow for accommodating climate change and still protect public trust resource populations.

Urban, Small Community, and Non-Urban Considerations:

There are many possible benefits to local and regional community economies from construction, water supply economies and recreation supported by improved salmon populations.

Regional Applicability:

All regions

Integration with Other Programs:

Central Valley Conservation Strategy (FESSRO). Major opportunities for integration with new water supply options and flexibility. Integrate with DRIWM and Delta ecosystem enhancements.

References:

DRAFT Management Action Evaluation

Management Action Title: MA-047

Set back levees to connect rivers to floodplains.

Description:

Problem:

Construction of levees immediately adjacent to streams, continual bank protection and channel stabilization not only reduces floodplain storage capacity resulting in larger downstream flooding, but can also severely modify natural geomorphic processes such as erosion, deposition, and channel meandering. Construction of levees also limits area available for riparian forest development resulting in loss of shaded riverine habitat, large woody debris, and limited insect availability for foraging fish. Channelization leads to higher flushing flows moving sediments and gravels out of the system resulting in a loss of material to be used by salmonids. Loss of river connection to floodplains also results in the loss of the shallow water overland flooding that periodically takes place which provides foraging and rearing habitat for young salmonids and splittail, allows for greater ground water recharge, and provides foraging habitat for wintering shorebirds and waterfowl.

Desired Outcome:

Expand the footprint of the flood system to reconnect floodplains, increase detention and attenuate flood flows, reduce downstream flood risks, minimize O&M costs, and restore critical habitats.

Methodology:

Identify areas where levees could feasibly be breached or set back from the existing low flow channel. Leverage existing knowledge and ongoing projects to identify opportunities for setting back levees.

CVFPP Goals

Contributes Significantly to: Promote Ecosystem Functions

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☑ Improve Operation and Maintenance
- ☑ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☑ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained for further evaluation

Advantages:

- Will work well in conjunction with other MAs involving ecosystem restoration, transient storage, and land use planning.
- Provides multiple benefits.
- Will also help to streamline permitting.

Disadvantages:

- Potential for setback levees may be limited in areas with extensive floodplain development.
- Potentially high costs of land acquisition and permitting complexities.

Economic Considerations:

Capital Cost? (High, Medium, Low)

High. Setting back levees may have significant capital cost associated with land acquisition and physical construction.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

This MA is likely to decrease the annual cost to operate/maintain/repair by reducing stress on levees and attenuating flood flows.

Potential for Cost-Sharing?

Potential for cost sharing with local flood control agencies, Federal, and non-governmental organizations.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Constructing setback levees can decrease stresses on the levees by attenuating flood flows thereby increasing the existing level of protection afforded and lowering the potential for flooding therefore reducing the frequency of emergency response and associated costs for recovery.

Flood fighting? (Increase, Decrease, or No Significant Change)

Constructing setback levees can decrease stresses on the levees by attenuating flood flows thereby increasing the existing level of protection afforded and lowering the potential for flooding and costs associate to fight floods.

Effect on Damage to Critical Public Infrastructure?

Constructing setback levees can decrease stresses on the levees by attenuating flood flows thereby increasing the existing level of protection afforded and lowering the potential for flooding and costs associate damages to infrastructure.

Effect on Floodplain and Economic Development?

This MA will place floodplain land inside of the footprint of the flood system, reducing the land available for future floodplain development.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Decreases State flood responsibility by increasing the conveyance capacity between levees and reducing flood frequency.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

Would rehabilitate key physical processes by reconnecting channels to historical floodplains, and enhancing sediment transport, channel and floodplain forming processes, groundwater recharge, and improving water quality, and would rehabilitate ecological functions by increasing riparian and wetland habitat area, quality diversity and connectivity, and by increasing spawning habitat (e.g., for Sacramento splittail) and salmonid rearing habitat. Vegetation restoration of the area between the setback the river channel allow for re-introduction of native riparian species along the river corridor. This habitat benefits the wildlife that traditionally used the area and allows for connectivity between DFG wildlife areas along the river corridor.

Adverse Environmental Impact?

Constructing setback levees could result in moderate to substantial permanent impacts to terrestrial and agricultural habitats, and potentially to canal or seasonal wetland habitats, and in impacts to associated special-status species; however, the resulting benefits of reconnecting the river to the floodplain could outweigh the impacts.

Permitting Considerations?

Extensive and complex

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

The magnitude of adverse effects to habitats resulting from flood system O&M would be reduced. The availability of restored habitat resulting from setback levee projects could be used to provide mitigation for future projects streamlining the permitting for those future projects.

Social Considerations:

Public Safety?

Improves public safety by increasing the conveyance capacity between levees and reducing flood frequency.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to provide significant water supply, recreation, and open space benefits. Reconnecting rivers to floodplains in low-risk areas provides an opportunity to increase groundwater recharge, improve water quality in a long-term sustainable way at

relatively low costs. Active flood plains and associated wetlands can temporarily store floodwaters, filter nutrients and impurities from runoff, process organic wastes, capture high sediment loads outside of the main flood channel, and moderate water temperature fluctuations. Construction of new linear features, such as setback levees, should always be considered for use as trail corridors, especially to connect existing trails or destinations of interest such as waterways and wildlife viewing areas.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Political and institutional acceptability is likely to depend on local jurisdictions.

Technical Considerations:

Redirected Hydraulic Impacts?

May result in redirected hydraulic impacts upstream.

Residual Risk?

Reduces the frequency of flooding, reducing residual risk to existing development.

Climate Change Adaptability:

This action would enhance hydrologic adaptability by increasing capacity to convey flood flows; and this action would increase biological adaptability by increasing habitat quantity, connectivity, complexity, and continuity along environmental gradients, and thus, increasing the viability of populations and their ability to adjust to and handle the consequences of climate change (e.g., extreme events). The addition of riparian forest would provide greater carbon sequestration and assist in meeting DWR's climate change goals. Would allow the system to better adapt to sea level rise without increasing flood risk due to greater channel capacity.

Urban, Small Community, and Non-Urban Considerations:

May be limited opportunities to set back levees in urban areas with significant floodplain development. Rural counties and levee districts will need to be included in decision making process.

Regional Applicability:

All regions

Integration with Other Programs:

Flood Corridors Program (Projects Office), Corridor Management Strategy (FMO), Central Valley Conservation Strategy (FESSRO)

References:

RCR; Delta Risk Management Strategy;

DRAFT Management Action Evaluation

Management Action Title: MA-048

Reconnect floodplains to restore seasonal habitat.

Description:

Problem:

In many locations, floodplains have been disconnected from rivers and streams through the construction of levees, transportation infrastructure, or other features. This disconnect has curtailed the various beneficial functions of natural floodplains, which can provide important seasonal habitat, floodwater storage and flow attenuation, infiltration/recharge, and other natural floodplain processes.

Desired Outcome:

Reconnect historical floodplains to increase flood water storage, attenuate flood flows, and enhance wetland and riparian habitats. Increased riparian forest restoration would also lead to greater carbon sequestration and reducing our impact on global climate change.

Methodology:

Reconnect historical floodplains by expanding the current flood corridors. Rivers and streams can be reconnected to their floodplains by removing or modifying embankments, levees, or other features that prevent flood flows from entering floodplains. This might include lowering levee crowns to permit overflows at certain flood stages, constructing weirs or other features to control the passage of flood flows into adjoining floodplains, or removing embankments completely. Floodplain restoration should consider potential conflicts with existing urban and agricultural uses, local zoning regulations, local economies, private property rights, and water rights.

CVFPP Goals

Contributes Significantly to: Promote Ecosystem Functions

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☑ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☑ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retain for further evaluation

Advantages:

- Will complement actions to develop transient floodplain storage for flood risk reduction.
- Promotes multiple benefits (flood risk reduction, groundwater recharge).
- Provides greater flexibility to adapt to changing climate conditions.

Disadvantages:

- Potential impacts to existing floodplain uses (site specific).
- Potential high costs for farmer compensation and/or land or floodway easement acquisition.
- Critical infrasturcture modifications may also result in significant costs.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Low to high initial investment, depending on location and extent of floodplain storage (cost factors include real estate acquisitions, relocations, mitigations cost, and complexity of structural modifications to existing facilities).

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Potential to increase annual maintenance costs depending on the maintenance requirements of the overflow area and

associated hydraulic structure(s).

Potential for Cost-Sharing?

Potential for non-governmental agency cost sharing and Federal cost sharing via contributions to existing federal project purposes (environmental restoration, flood risk reduction, water supply)

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Cannot determine at this time.

Flood fighting? (Increase, Decrease, or No Significant Change)

Cannot determine at this time. Could be indirect effects if the State maintained the floodway increase.

Effect on Damage to Critical Public Infrastructure?

Cannot determine at this time (site specific), but could put additional strain on infrastructure not originally designed to withstand seasonal flooding (i.e. bridges, buried pipelines, electrical transmission towers, cell towers).

Effect on Floodplain and Economic Development?

Reconnection of floodplains and restoration of seasonal habitat would affect existing and potential future uses of those lands (prevent future urban development); could have negative impact on local economies. There is also a possibility to limit seasonal agricultural activities depending on the location.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

This action would likely be combined with creation of transitory storage and therefore may increase the area of responsibility, but decrease the potential for liability. Floodplains also have a natural capacity for flood storage, which can help attenuate flood peaks and reduce both peak stages and velocities in adjacent river channels.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

Reconnection would restore natural floodplain processes and support seasonal habitat development (seasonal wetland, spawning and rearing habitat, riparian, shaded riverine aquatic). The restoration of seasonal habitat will benefit native riparian vegetation and wildlife habitat. Riparian restoration will benefit river corridor connectivity for multiple species. These benefits will result in general benefits to all flora and fauna species and even more so to endangered species.

Adverse Environmental Impact?

Unable to determine at this time (site specific, and dependent upon land uses and habitat currently existing in floodplains to be reconnected); construction activities associated with this measure (embankment removal, weir or overflow construction) could have minor to moderate, temporary impacts (and potentially permanent impacts); however, these impacts would likely be offset by the benefits associated with floodplain restoration. Fish stranding would need to be a design consideration to avoid impacts to special-status and native fish species.

Permitting Considerations?

Minor to substantial, but streamlined depending on site specifics. Possibility to provide advance mitigation credits thereby streamlining the permitting process.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

Additional transitory storage and seasonal habitat creation would benefit fish and wildlife species and likely reduce maintenance requirements by relieving pressure on surrounding levees during flood events. Any maintenance requirements could be offset by the mitigation credits for habitat creation.

Social Considerations:

Public Safety?

Floodplains have a natural capacity to attenuate floods; reconnection and restoration have the contributing potential to

improve public safety beyond what has already been accomplished with Yolo Bypass, Sutter Bypass, and Butte Sink.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to contribute to groundwater recharge, water quality improvement

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Potential implementation challenges relate to changes in existing and potential future land uses, land acquisition, responsibilities for long-term maintenance of restored habitat

Technical Considerations:

Redirected Hydraulic Impacts?

Site specific depending on location, but could put additional strain on infrastructure not originally designed to withstand seasonal flooding (i.e. bridges, buried pipelines, electrical transmission towers, cell towers).

Residual Risk?

No expected change, but unknown at this time.

Climate Change Adaptability:

This action would enhance hydrologic adaptability by increasing water management flexibility, and would enhance biological adaptibility by improving habitat connectivity and increasing habitat quantity to sustain population viability. Carbon sequestration abilities would also increase.

Urban, Small Community, and Non-Urban Considerations:

Floodplain restoration likely not feasible in urban areas or areas with small communities. Therefore, this is likely to occur in rural areas which will require stakeholder participation and buy-in from ranchers and farmers, which may be difficult.

Regional Applicability:

Potentially in all regions.

Integration with Other Programs:

Flood Corridors Program (Projects Office); FESSRO; FMO

References:

TFNBBF, 2002

DRAFT Management Action Evaluation

Management Action Title: MA-049

Encourage compatible land uses with flood management system and floodplain function.

Description:

Problem:

Much of the new development in the Central Valley is occurring in areas that are susceptible to flooding. Urbanization in floodplains increases the potential for flood damage to homes, businesses, and communities. Land use decisions made at the local level often allow development in floodplains and create situations that are incompatible with the flood management system and existing flood protection for the area. With a limited understanding of the beneficial functions of floodplains, some assert that floodplain management decisions have often been made outside of the context of watershed-level planning and without adequate consideration for natural and beneficial floodplain functions.

Desired Outcome:

By coordinating local land-use decisions with State flood protection, there is an opportunity to better plan development that is more compatible with the flood management system. Decisions made at the local level that provide flood protection can also benefit the community with areas of open space, parkways, trails, or habitat lands.

Methodology:

The State should encourage counties to identify and delineate appropriate and allowed urban and rural land uses within floodplains and identify ways, where feasible, that flood prone lands can serve multiple uses, such as groundwater recharge, recreation, or habitat. The State could define criteria for how developers know if they are meeting standards for development in areas that are at risk of flooding. In addition, the State could work with counties to promote urban development that attempts to retain existing or natural hydrologic conditions through the employment of Low Impact Development (LID) techniques. LID techniques seek to maximize the area available for infiltration so that peak flow rates, runoff volume and pollutant concentrations are reduced. Research should also be conducted and recommendations made regarding appropriate cropping or agricultural practices for certain areas, i.e. floodways vs. channel in order to reduce damages sustained by agricultural areas after floods.

CVFPP Goals

Contributes Significantly to: Improve Institutional Support

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☑ Improve Operation and Maintenance
- ☑ Promote Ecosystem Functions
- ☑ Improve Institutional Support
- ☑ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Not retained; inconsistent with DWR policy in maintaining local jurisdiction's land use authority.

Advantages:

• The consistency of land use compatibility considerations between the State and local jurisdictions would further align the strategy for long-term sustainability.

Disadvantages:

• The State does not have land use authority, which is resided in local jurisdictions.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Low capital costs. Measures put in place consist of policies, best management plans, financial incentive programs, educational programs, and does not involve physical construction.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Decrease in O&M costs. Increased integration of land use planning with flood management will result in land use practices that are more compatible with the flood management system and the natural system, which may reduce stress on the flood management system and hence provide a net reduction in O&M and repair. LID will reduce runoff and lower peaks, which could also reduce stress on system.

Potential for Cost-Sharing?

Federal, State and local agencies would be involved. Potential cost sharing through federal and State grant/loan programs, cost sharing agreements, and developer-based incentives.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Potential to reduce long-term costs for emergency response and recovery. The frequency and consequences of flooding would be reduced.

Flood fighting? (Increase, Decrease, or No Significant Change)

Reduction in frequency and consequence of flooding would reduced long-term costs of floodfighting.

Effect on Damage to Critical Public Infrastructure?

Long-term reduction in damage to critical infrastructure. Best management practices would direct placement of critical infrastructure out of harm's way.

Effect on Floodplain and Economic Development?

Directly effects floodplain development. Land use decisions would be made from a watershed level perspective and land use decisions would be compatible with flood management system uses.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential to reduce State Flood responsibility by reducing frequency and consequences of flooding.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

Comprehensive land use planning in floodplains could result in rehabilitation of key physical processes and ecosystem functions by identifying and setting aside areas where rehabilitation would be most beneficial for habitats and flood management and restricting development there.

Adverse Environmental Impact?

None

Permitting Considerations?

Land use decision have potential to change existing permitting process

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Potential to improve public safety by reducing frequency and consequences of flooding.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Increased potential to provide other benefits, such as recreation, water supply thru enhanced recharge, agriculture, and habitat enhancement.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Not implementable without significant changes in legislation regarding land use authority.

Technical Considerations:

Redirected Hydraulic Impacts?

No redirected hydraulic impacts.

Residual Risk?

Potential reduction in consequences could reduce residual risk.

Climate Change Adaptability:

This action would enhance hydrologic adaptability by providing additional capacity to convey flood flows and reducing the consequences of the increased flood frequencies and greater flows anticipated to result from climate change; also, the use of LID techniques could decrease peak flows, and thus, reduce the impacts of extreme precipitation events. This action also could enhance biological adaptability by increasing habitat quantity, connectivity, and continuity along environmental gradients; and thus, increasing the ability of species to handle and adjust to the consequences of climate change.

Urban, Small Community, and Non-Urban Considerations:

MA could be practiced in all types of communities settings, however land use management needs are different for non-urban settings compared to urban. More opportunity in small communities and non-urban settings where land use not yet developed.

Regional Applicability:

Applies to all regions

Integration with Other Programs:

State mapping and outreach programs (i.e. building codes, risk notification, general plan updates, CRS)

References:

Delta Risk Management Strategy; California Floodplain Management Task Force, 2002, Final Recommendations Report; RCR;

DRAFT Management Action Evaluation

Management Action Title: MA-050

Establish clear triggers or policy for updating flood management-related General Plan elements and other local flood management plan(s).

Description:

Problem:

The most recent and applicable data is not always available or used for updates to local flood management and land use planning documents, resulting in outdated planning strategy and reduced benefits. Many flood related regulations and planning are associated with a defined level of protection, in other words, an event of certain return frequency. The frequency based management strategy would often be impacted by significant events that change the statistics and/or consideration of the climate change effects and uncertainties in hydrologic condition forecast.

Desired Outcome:

State and local agencies could manage floodplains more proactively and adaptively and need to have access to the most recent hydrologic, climate, physical and biological conditions, policies and land use data in order to adequately update planning documents for land use and flood management. In particular, updates could be triggered by the 5-year updates of the Central Valley Flood Protection Plan and major flood events.

Methodology:

The State should update the General Plan Guidelines to reflect the California Floodplain Management Task Force recommendations, as applicable, and to reflect other programs, policies, and standards, including the NFIP, for floodplain management. Similarly, local jurisdictions should update their General Plan and other flood management plan(s) to reflect the updates, at a minimum level, the update should be triggered by the 5-year update of the CVFPP and occurrence of major flood events that change the frequency of events used as reference in the local plans. New data developed by local agencies for flood management planning purposes (i.e. new hydraulic models) should also be integrated into planning documents when updated.

CVFPP Goals

Contributes Significantly to: Improve Institutional Support

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☑ Improve Operation and Maintenance
- ☑ Promote Ecosystem Functions
- ☑ Improve Institutional Support
- ☑ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retain for further evaluation

Advantages:

- Having clear triggers for Policy and General Plan updates will remove confusion as to what the local entities are to do in response to the adoption of the CVFPP.
- Improves overall public safety, property protections and provides economic benefits statewide.

Disadvantages:

- Not al local agencies will react the same to a "clear" trigger, some will try to use their own interpretation as long as it suits their needs.
- Some requirements could be politically sensitive.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Low capital costs. Measures put in place consist of policies, plans, improved tools, and does not involve physical construction.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Decrease in O&M costs. Improvements in flood planning could result in management practices that are more compatible with the flood management system and the natural system, which may reduce stress on the flood management system and hence provide a net reduction in O&M and repair.

Potential for Cost-Sharing?

Indirectly. The federal and state agencies could identify the level of acceptable information used in local plans as part of the criteria for determining cost share, federal and state grant/loan programs and other incentive programs.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Improved and updated land use and other management plans would potentially reduce long-term costs for emergency response and recovery. Improved land use and flood management planning should improve ability to manage floods and reduce the frequency and consequences.

Flood fighting? (Increase, Decrease, or No Significant Change)

Reduction in frequency and consequence of flooding would reduced long-term costs of floodfighting.

Effect on Damage to Critical Public Infrastructure?

Long-term reduction in damage to critical infrastructure. More frequent and comprehensive updates of land use plans would provide better guidance for planning and placement of future critical infrastructure, reducing chances for damages.

Effect on Floodplain and Economic Development?

Directly effects floodplain development. Land use planning would be more robust given the better data, tools, and frequency of updates.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential to reduce State Flood responsibility by reducing consequences of flooding through land use planning

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

Likely, but depending on whether the concept was incorporated in the original plan. The updates would continue to improve the intent, if incorporated in the original design, to be more current and durable. The positive effect under this consideration is likely to come from other management actions compatible to this one.

Adverse Environmental Impact?

None

Permitting Considerations?

None

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Potential to improve public safety by avoiding putting residents in harm's way through land use planning in comparing scenario without proper/timely updates.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Increased potential to provide other benefits through improved land use planning, which could provide recreation, water supply, agricultural, and habitat benefits.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Overall, improved land use management would be favorable to overall general public, government agencies, but some resistance by cities/counties that depend on tax base, and development industry.

Technical Considerations:

Redirected Hydraulic Impacts?

No redirected hydraulic impacts.

Residual Risk?

Potential reduction in consequences could reduce residual risk in comparing scenario without proper/timely updates.

Climate Change Adaptability:

Updated land-use plans that incorporate climate change scenarios could support enhancement of hydrologic adaptability by incorporating flexibility and additional capacity into the system, and thus, reduce the consequences of the increased flood frequencies and flows anticipated to result from climate change. If these land-use plans provide opportunities for restoration of habitat, this action could enhance biological adaptability by increasing habitat quantity, complexity, connectivity, and continuity along environmental gradients.

Urban, Small Community, and Non-Urban Considerations:

MA could be practices in all types of communities settings, however benefits and improved land use planning would probably have greater short-term benefits in the more complex urban settings, and longer-term benefits in small community areas that are expected to grow in coming decades.

Regional Applicability:

Applies to all regions.

Integration with Other Programs:

Implementing California Flood Legislation into Local Land Use Planning Handbook for Local Communities (and associated public workshops) (LRFMO), Building codes, and CRS.

References:

Environmental Sustainability Summary; California Floodplain Management Task Force, 2002, Final Recommendations Report; RCR; Flood Warning: Responding to California's Flood Crisis.;

DRAFT Management Action Evaluation

Management Action Title: MA-051

Update State's designated floodway program.

Description:

Problem:

The existing designated floodways are based on the passage of then-defined design flood. The designation requires re-evaluation because of the 2007 Flood Legislation that specifies increase in the desired level of protection for the urban and urbanizing areas, the past several severe floods, and the potential changes in hydrologic conditions from climate change.

Desired Outcome:

Additional floodways could be designated as part of the SPFC to ensure consistency with the current requirements and understanding of hydrologic conditions.

Methodology:

In order to provide 200-year (or greater) level of flood protection to all urban and urbanizing areas in the Sacramento - San Joaquin Valley by December 31, 2025, the State will need to define the 200-year flood and the corresponding share of the compliance responsibility to be accomplished by flood control system facilities. Additional designated floodway and improved levee design and construction standards could contribute to the desired protection under the greatest range of conditions (e.g., overtopping, earthquake, wind/wave erosion, etc.) and reduce O&M frequency and costs and extend life cycle, by 2025.

CVFPP Goals

Contributes Significantly to: Improve Institutional Support

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☑ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☑ Improve Institutional Support
- ☑ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retain for further evaluation

Advantages:

- Designated floodway is part of the system infrastructure to accomplish the desired level of protection.
- The update and reevaluation of needs would help to establish the active management of those sections to reduce the chance of flooding.

Disadvantages:

- Designation of floodway would require additional considerations of land acquisitions (though not required) or easements.
- The designated floodways would be integral parts of the system and thus, would involve physical changes, construction, design, and other capital expenditure.

Economic Considerations:

Capital Cost? (High, Medium, Low)

High capital costs. Adding floodways and changing levee design standards would result in physical changes to flood management at a significant capital expense.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Increase in O&M costs and repair costs. Additional floodways means more things to operate, maintain, and repair.

Potential for Cost-Sharing?

Federal-state cost sharing for improvements to SPFC.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Potential to reduce emergency response and recovery costs due to reduction in frequency and consequences of flooding.

Flood fighting? (Increase, Decrease, or No Significant Change)

Potential to reduce flood fighting due to reduction in frequency and consequences of flooding.

Effect on Damage to Critical Public Infrastructure?

Long-term reduction in potential damage to critical public infrastructure as a result of reduced frequency of flooding due to addition of floodways.

Effect on Floodplain and Economic Development?

Could eliminate opportunity for urban develop due to designation of new floodways but could provide opportunities for other development, both within the new designated floodway (agricultural, recreational, and habitat uses) and also in neighboring communities that might have the benefit of improved flood protection that would allow for expansion of development in existing floodplains.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential to reduce State Flood responsibility by reducing frequency and consequences of flooding.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

None

Adverse Environmental Impact?

None

Permitting Considerations?

None

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Potential to improve public safety by reducing frequency and consequences of flooding.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Increased potential other benefits, such as agriculture/recreation/habitat in new designated floodways

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Would have strong support from urban communities in need of greater protection; and less support from environmental and rural communities that would receive less benefit, or no benefit, of new floodways.

Technical Considerations:

Redirected Hydraulic Impacts?

Could potentially redirect hydraulic impacts to rural and open space areas.

Residual Risk?

Potential reduction in consequences could reduce residual risk.

Climate Change Adaptability:

This action is not directly related to adaptability, but would enhance the adaptability of public health, and could increase the feasibility and cost efficiency of ecosystem restoration projects that enhance hydrologic and biological adaptability.

Urban, Small Community, and Non-Urban Considerations:

MA would likely be more applicable to rural settings where space exists for designating floodways

Regional Applicability:

Applies to all regions under the CVFPB's jurisdiction and where the designated floodway could be effective. These areas are likely in riverine corridors, but not in the tidal influenced Delta area.

Integration with Other Programs:

Federal and State mapping programs

References:

Flood Warning: Responding to California's Flood Crisis.;

DRAFT Management Action Evaluation

Management Action Title: MA-052

Use Building Code amendments to reduce consequence of flooding

Description:

Problem:

The existing mandatory Building Code provisions related to flood protection are required for the Special Flood Hazard Area that could be inundated by the flood event having a 1-percent chance of being equaled or exceeded in any given year (a.k.a, the base flood or 100-year flood). The Building Code address flood protection mainly is through elevation of structures. This approach has limited effectiveness in the Central Valley where flood depths could be more than 20 feet. The urban level of protection required by 2007 Flood Legislation is for 200-year flood, exceeding the FEMA base flood.

Desired Outcome:

Additional mandatory Building Code provisions to protect residents in the Central Valley from death and severe injury during floods, and increase the resilience of the building to reduce damage and required time for recovery.

Methodology:

The 2007 Flood legislation provides guidance in developing building code amendment to protect lives and reduce flood damage in the State Plan Flood Control Planning Area, where the flood depth is expected to be above 3 feet in a 200-year event. The focus is on the deep floodplains in the Central Valley with high possibilities of floodwater ponding. This can be the starting and minimum threshold of this management action. Building code amendments can include various structural improvements for public safety reasons and for dry and wet proofing tactics to reduce overall consequence of flooding. The proposed building code amendments need to be adopted by the California Building Standard Commission, as either mandatory or voluntary requirements. The development of proposed code amendments would be consistent with the national standards and other California code development trends. Due to the various types of buildings and business sectors associated with each building occupancy categories, the requirements may have to be customized for individual occupancy, in coordination with relevant state regulatory agencies and major industrial and professional groups. DWR is embarking on a review of various occupancy types with an initial focus on educational, institutional, and recreational occupancies. As with most building code amendments, the proposed code amendment would apply to new construction and existing buildings that require significant improvement and upgrade. Cost estimates for required improvements and upgrades for single residential houses were completed on a voluntary basis and adopted by the Commission in 2001, with the support by the Building Industry Association. This will serve as a starting point for assessing across all building occupancy categories the required improvements and upgrades for existing buildings affected by the proposed code amendment.

CVFPP Goals

Contributes Significantly to: Improve Institutional Support

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☑ Improve Institutional Support
- ☐ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained; maintaining the scope consistent with the Health and Safety Code Section 50465, as authorized in the 2007 Flood Legislation as the CVFPP development.

Advantages:

- Reduce the potential flood damage and life loss in deep flooding conditions.
- Increase the level of accessibility for rescue, the building

Disadvantages:

- Significant agency and interest group coordination is required because of the various occupancy groups that may be affected by the proposed code amendment, and

resilience for faster recovery. • Decrease the burdens of state's and federal's programs for emergency response, recovery and assistance in the long run. • Reduces residual risk regardless of the accomplishment from the reduction of chance of flooding. • Promote reasonable land use planning and building integrity in deep floodplains.	customization is required. • The intended evacuation direction for a building in a deep flooding condition is opposite to the current evacuation routes established for most disasters or emergency; therefore, public education is likely to be a significant challenge. • The associated ADA requirements, where applies, could also be a significant compliance and cost challenges for some sectors such as commercial buildings and schools. • The application of building code amendments is limited to new constructions and existing buildings with significant improvement and upgrade; therefore, it would not provide an uniform improvement on building safety and resilience during floods. • Should the code amendment be adopted as voluntary items, the reinforcement and the anticipated outcomes may vary significantly from jurisdiction to jurisdiction .

Economic Considerations:

Capital Cost? (High, Medium, Low)

Relative low capital costs for implementing code changes. Cost to change codes relatively low. The additional cost to implement the new codes, such as the added costs of building officials reviewing plans and permitting applications, could be recovered through additional fee requirements or development agreements. The additional cost to developers for meeting the new code requirements would be recovered through additional fees added to the lease or purchase price of the property.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

There may be an increase in costs associated with increased enforcement, inspection, and potential flood drills, subject to the actual code proposal.

Potential for Cost-Sharing?

Not applicable.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Potential to facilitate rescue activities during deep flood conditions, reduce long-term costs for emergency response and recovery through the reduction of flood damage to property.

Flood fighting? (Increase, Decrease, or No Significant Change)

Not applicable.

Effect on Damage to Critical Public Infrastructure?

Potential to improve building construction of critical infrastructure, preserve the function and/or reduce damage to critical infrastructure, and enable faster recovery if improvements on floodproofing tactics and material are use.

Effect on Floodplain and Economic Development?

There may be economic effects on some business sectors; however, this would be evaluated by the Commission as part of the adoption process. The building code amendment may encourage different types of buildings to be developed in the floodplain, but not likely to have significant impacts on local economic development.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential to reduce the state's responsibility in emergency response and local assistance programs.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

Not applicable.

Adverse Environmental Impact?

Not applicable.

Permitting Considerations?

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

Not applicable.

Social Considerations:

Public Safety?

Potential to increase public safety through implementation of floodproofing, elevating, and other building improvements that allows egress during a flood event.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

None identified.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

If properly scoped and coordinated, the building code amendment would be implemented -- as evident by the 2010 adoption of the code amendment for single residential buildings.

Technical Considerations:

Redirected Hydraulic Impacts?

Not applicable.

Residual Risk?

The building code amendment will reduce the residual risk.

Climate Change Adaptability:

The building code amendment should be considered in coordination with other regulatory developments for climate change, including the land use planning and specific building code amendment (such as the Green code adopted in 2009). The accumulative effects of various regulations and law requirements should be considered for their consistency to improve climate change adaptability.

Urban, Small Community, and Non-Urban Considerations:

Building code only establishes the minimum for buildings that are subject to the code regulation and permits issued by the local building officials and other relevant jurisdictions (such as the Department of State Architect, and California State Fire Marshal, or Office of Statewide Health Planning and Development). These requirements, where applicable, are not bounded by urban, small community, or non-urban designation.

Regional Applicability:

DWR intends to follow the legislation requirements to limit the building code amendment applied to only the State Plan of Flood Control Planning Area, where the flood depth may exceed 3 feet in a 200-year event. It would be up to the local jurisdictions to consider applicability and adoptions for use in other areas.

Integration with Other Programs:

Building Standards Code Update Project (LRFMO), CRS, and local general plans

References:

DRAFT Management Action Evaluation

Management Action Title: MA-053

Update state and local floodplain management policy to be consistent with FEMA requirements for maintaining eligibility for NFIP participation and federal financial assistance.

Description:

Problem:

Inconsistencies exist between Federal, State and local regulations regarding building codes, development within floodplains and the subsequent effect on NFIP eligibility. FEMA has notified the State that the existing Governor's Executive Order B-39-77 does not effectively bring the State and its political subdivisions into compliance with the NFIP. The order has not been updated for more than 30 years and does not reflect current knowledge of the risks associated with development in floodplains. The Governor's Executive Order requires updating pending update of Federal Executive Order, which is in progress. According to FEMA, continued noncompliance with the NFIP could endanger the State's ability to obtain federal financial assistance, including federal disaster assistance and USDA and U.S. Department of Housing and Urban Development (HUD) funding, for buildings located in FEMA's regulatory floodplains.

Desired Outcome:

The State could ensure that the California Building Standards Code meets, at minimum, NFIP requirements, and that other State codes applicable to public buildings meet, at a minimum, NFIP requirements. Any local code adoptions or amendments and any development approvals could also meet, at a minimum, NFIP requirements. The Governor's Executive Order should be updated to be consistent with Federal Executive Order.

Methodology:

Governor's Executive Order B-39-77, which includes California's policies for building State facilities within floodplains, should be updated. The update could be based on the recommendations from the California Floodplain Management Task Force in 2002, or developed through a method of equivalent effectiveness, and the update should be consistent with the Federal Executive Order. Local communities should require new and substantially improved buildings to have their lowest floor elevations to be at least one foot above the NFIP's base flood elevation, factoring in the effect of full build out of the watershed. The effects of new or additional flood management measures should be reflected in an updated base flood elevation. In raising a structure, the entire floor space or portion occupied is elevated above the expected flood elevation. The benefits of elevating a structure can include: reduced future flood damages, increased square footage suitable for storage or parking, increased property value, improved appearance, and lowered flood insurance premiums.

CVFPP Goals

Contributes Significantly to: Improve Institutional Support

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☑ Improve Institutional Support
- ☐ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retain for further evaluation

Advantages:

- Updating the policies and regulations so they are consistent will continue to allow California to be eligible for participating in NFIP, and allow local agencies to receive future federal financial assistance.
- There is minimum costs for updating the policies and

Disadvantages:

- Adoption and enforcement by local jurisdictions can be affected by resources limitations; however, this challenge may have relationship to the lack of understanding for their actions related to their eligibility of NFIP coverage and financial assistance.

regulations is, however, there is a higher cost for actual implementation of them.	• Also there are some potential political challenges with adoption and enforcement.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Low for MA development. Policy MAs will tend to have a substantially lower capital cost than other MAs which involve physical construction. Upon implementation, which could require retrofitting existing buildings to be compliant, could result in higher costs.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

not applicable

Potential for Cost-Sharing?

Potential for federal grants and local cost sharing associated with actions needed to meet requirements.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Potential to reduce the consequences of flooding; thereby reducing long-term costs of emergency response and recovery. On the other hand, the compliance will allow them to receive the federal financial assistance after flooding

Flood fighting? (Increase, Decrease, or No Significant Change)

not applicable

Effect on Damage to Critical Public Infrastructure?

Potential reductions in damage to critical public infrastructure if compliance with the elevation requirements. Additional federal assistance may help the recovery of critical public infrastructure.

Effect on Floodplain and Economic Development?

The continued eligibility for NFIP and federal financial assistance is critical for existing and future floodplain and economic development.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

The ineligibility for NFIP and federal financial assistance will potentially increase the State's responsibility in flood disaster assistance, which traditionally relies on federal support significantly.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

None

Adverse Environmental Impact?

None

Permitting Considerations?

Could impact permitting process and decisions

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

May improve public safety by reducing consequences of flooding, and provide greater opportunities for financial assistance to reduce secondary consequence of flooding on public safety.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Could impact decisions regarding open space, water supply, parks and recreation

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Significant support for this MA at federal and local level. Funding for local agencies has been challenging. Implications to construction industry may create hurdles. Could be politically sensitive, and create economic burden without significant federal and State funding options.

Technical Considerations:

Redirected Hydraulic Impacts?

Not applicable.

Residual Risk?

NFIP and financial assistance are major strategies in addressing residual risks.

Climate Change Adaptability:

Under consideration by NFIP

Urban, Small Community, and Non-Urban Considerations:

Building standards adoption and enforcement can be challenging in small communities and rural areas due to resources limitations

Regional Applicability:

All regions

Integration with Other Programs:

Building Standards Code Update Project (LRFMO), CRS, federal and state mapping programs, general plans

References:

RCR; California Floodplain Management Task Force, 2002, Final Recommendations Report; USACE 2001 Sacramento and San Joaquin River Basins Comprehensive Study;

DRAFT Management Action Evaluation

Management Action Title: MA-054

Develop regional and river-corridor conservation plans, or expand existing regional conservation plans (such as regional Habitat Conservation Plans and Natural Community Conservation Plans) to provide a more efficient and effective regulatory approval process for flood projects.

Description:

Problem:

Habitat and ecosystem planning is conducted in piecemeal, fragmented fashion in many parts of the planning area. Multiple regulatory agencies are responsible for ensuring the protection or mitigation of environmental resources impacted by flood management activities. Limited coordination and shared vision results in a regulatory approval process that adds complexity and scheduling challenges to flood project approvals. It also results in fragmented conservation projects that may have limited viability in terms of long-term biological success.

Desired Outcome:

High-quality regional and river-corridor conservation plans that both improve flood project regulatory approval and provide improved habitat that is viable for the long-term.

Methodology:

Develop plans such that they provide measurable biological objectives for targeted resources, incorporate adaptive management approaches, fund long-term habitat management and monitoring, and provides the public with the opportunity to assess, review, and critique plans as they are being developed.

CVFPP Goals

Contributes Significantly to: Improve Institutional Support

Potentially Contributes to (Check all that apply):

- ☐ Improve Flood Risk Management
- ☑ Improve Institutional Support
- ☑ Improve Operation and Maintenance
- ☑ Promote Multi-Benefit Projects
- ☑ Promote Ecosystem Functions

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retain for further evaluation

Advantages:

• Will work well in conjunction with other MAs involving ecosystem restoration, agency coordination, and land use planning.

Disadvantages:

• Does not directly improve reduce flood risk management.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Medium . Plans such as NCCPs require adequate funding to develop. Implementation of the plans, which constitute other management actions, will have varying capital costs

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

No change. Plans require some minimal annual funding to ensure good communication among partners and to develop adaptive solutions to changed or unforeseen circumstances. But this cost can be offset by cost-savings associated with more efficient implementation.

Potential for Cost-Sharing?

High potential for cost sharing among various agencies with responsibilities for ecosystem planning and flood system operations and maintenance.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Improved regional coordination will likely have no significant change on emergency response and recovery costs.

Flood fighting? (Increase, Decrease, or No Significant Change)

Improved regional coordination will likely have no significant change on flood fighting costs.

Effect on Damage to Critical Public Infrastructure?

Improved regional coordination will likely have no significant effect on damage to critical public infrastructure.

Effect on Floodplain and Economic Development?

Regional conservation plans will help to direct land development projects toward areas where they will have the least impact on both flood management and habitat conservation goals.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Improved regional coordination will likely have no significant negative effect on State flood responsibility. More effective regional coordination between agencies could improve the ability to meet our flood responsibilities.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

Increased regional collaboration among habitat and ecosystem planning and mitigation would result in rehabilitation of ecosystem functions by concentrating mitigation in larger areas, and by selecting more suitable lands for mitigation than is possible with piecemeal mitigation.

Adverse Environmental Impact?

None

Permitting Considerations?

Improved and streamlined permitting for future projects.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

Impacts associated with flood system O&M could be reduced because O&M would be better facilitated and mitigation better coordinated.

Social Considerations:

Public Safety?

This MA is not likely to directly affect public safety.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Conservation plans provide opportunities to improve water quality, increase open space, and manage recreation in ways that are compatible with overall CVFPP goals

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

California has over 30 regional conservation plans in varying stages, with some plans in the implementation phase for over 10 years. Corridor management plans are under development, and they are being viewed as valuable approaches for meeting multiple flood management goals on specific reaches

Technical Considerations:

Redirected Hydraulic Impacts?

None

Residual Risk?

N/A

Climate Change Adaptability:

This action would enhance biological adaptability by increasing the effectiveness of conservation actions for enahncing the ability of populations to handle and adjust to the consequences of climate change by increasing the extent, connectivity, complexity, and continuity of habitats across environmental gradients, which would increase the size and viability of populations. Many existing conservation plans currently are incorporating climate change as part of their long-term objectives.

Urban, Small Community, and Non-Urban Considerations:

No specific considerations identified.

Regional Applicability:

All regions

Integration with Other Programs:

Central Valley Conservation Strategy (FESSRO), Corridor Management Strategy (FMO), Interagency Flood Management Collaborative Program, Flood Corridor Program (Projects Office), Natural Community Conservation Plans and Habitat Conservation Plans (several), Riparian Habitat Joint Venture, Central Valley Habitat Joint Venture, species recovery plans

References:

White Paper; Agricultural Stewardship White Paper; Environmental Sustainability Summary;

DRAFT Management Action Evaluation

Management Action Title: MA-055

Develop regional advance mitigation strategies and networks of mitigation banks to meet the needs of flood and other public infrastructure projects.

Description:

Problem:

Although many flood projects can avoid or greatly reduce their impacts to habitat, some projects require offsite mitigation to compensate for habitat losses. Identifying suitable off-site locations is often left to the last phase of flood projects, as it becomes more evident about the extent and nature of the expected impact. Regulatory agencies need to approve these off-site locations, and negotiations can delay overall flood project approvals. A second problem is the temporal loss of habitat, which occurs between the time when the flood project removes habitat and the time when compensatory habitat is restored to pre-project levels. A third problem is that off-site locations that are comparable in area to the impact are often too small and isolated to have long-term viability. To remain viable in perpetuity, as required, such small areas often require high ongoing maintenance costs.

Desired Outcome:

High quality regional advance mitigation strategies and networks of mitigation banks that meet the needs of flood and other public infrastructure projects.

Methodology:

Develop supporting State and federal policies, and sustainable funding sources within the State and federal budgets, and develop partnerships with regulatory agencies for planning and implementation of comprehensive regional advance mitigation banks.

CVFPP Goals

Contributes Significantly to: Improve Institutional Support

Potentially Contributes to (Check all that apply):

- ☐ Improve Flood Risk Management
- ☑ Improve Institutional Support
- ☑ Improve Operation and Maintenance
- ☑ Promote Multi-Benefit Projects
- ☑ Promote Ecosystem Functions

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retain for further evaluation

Advantages:

- Will work well in conjunction with other MAs involving ecosystem restoration, agency coordination, and land use planning.

Disadvantages:

- Does not directly improve reduce flood risk management.

Economic Considerations:

Capital Cost? (High, Medium, Low)

High. Establishment of mitigation banks requires acquisition of land, restoration, and funding for long-term management and monitoring.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Regional collaboration for advance mitigation banks is likely to decrease overall costs of regulatory compliance and mitigation for operations, maintenance, and repair activities.

Potential for Cost-Sharing?

High potential for cost sharing among various agencies with responsibilities for ecosystem planning and flood system operations and maintenance.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Developing regional mitigation banks will likely have no significant change on emergency response and recovery costs.

Flood fighting? (Increase, Decrease, or No Significant Change)

Developing regional mitigation banks will likely have no significant change on flood fighting costs.

Effect on Damage to Critical Public Infrastructure?

Developing regional mitigation banks will likely have no significant change on damages to public infrastructure.

Effect on Floodplain and Economic Development?

Implementation of advance mitigation banks may reduce the floodplain area available for future development.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Implementation of advance mitigation banks will likely have no significant negative effect on State flood responsibility.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

Implementation and coordination on regional advance mitigation planning would result in rehabilitation of ecosystem functions by concentrating mitigation in larger areas, by implementing mitigation in advance of impacts, and by selecting more suitable lands for mitigation than is possible with piecemeal mitigation.

Adverse Environmental Impact?

None

Permitting Considerations?

Improved and streamlined permitting for future projects.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

Impacts associated with flood system O&M could be reduced because O&M would be better facilitated and mitigation better coordinated.

Social Considerations:

Public Safety?

This MA is not likely to significantly directly affect public safety.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Regional advance mitigation banks will increase open space and recreation values. Wetlands created in mitigation banks can yield water quality improvements.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

There is high interest in developing regional advance mitigation banks from infrastructure agencies, resource agencies, and conservation organizations. Private mitigation banks already exist and regulatory agencies have developed standard approval processes for establishing these banks.

Technical Considerations:

Redirected Hydraulic Impacts?

None

Residual Risk?

N/A

Climate Change Adaptability:

This action would enhance biological adaptability by increasing the effectiveness of conservation actions for enahncing the ability of populations to handle and adjust to the consequences of climate change by increasing the extent, connectivity, complexity, and continuity of habitats across environmental gradients, which would increase the size and viability of populations.

Urban, Small Community, and Non-Urban Considerations:

No specific considerations identified.

Regional Applicability:

All regions

Integration with Other Programs:

Central Valley Conservation Strategy (FESSRO), Corridor Management Strategy (FMO), Interagency Flood Management Collaborative Program , Flood Corridor Program (Projects Office), Natural Community Conservation Plans and Habitat Conservation Plans (several), Riparian Habitat Joint Venture, Central Valley Habitat Joint Venture, species recovery plans

References:

DRAFT Management Action Evaluation

Management Action Title: MA-056

Develop regional permitting approaches such as corridor management strategies (CMS).

Description:

Problem:

Numerous permits are required to conduct regular maintenance activities on the state-federal flood protection works for routine maintenance. Challenges associated with permitting include the costs associated with documentation and mitigation, length of the process, restrictive conditions, and conflicting state and federal priorities. furthermore, limited construction work windows, uncertainty regarding which permits are required for routine maintenance, and limited coordination among the various entities issuing permits had resulted in the deferral of important maintenance activities. Many levee maintaining agencies have limited staff resources and funding, and have expressed concern over the amount of their operating budgets that are dedicated to obtaining permits to perform required maintenance. This situation creates regulatory uncertainty for both the State, LMA's and regulatory agencies.

Desired Outcome:

Implement a regulatory compliance strategy that standardizes and streamlines the permitting process (timeliness and efficiency), reduce costs, and promotes regional efforts that support more successful mitigation.

Methodology:

A key to the success of any effort to streamline permitting would be the establishment of a consistent, widely-recognized definition of "routine maintenance" and the activities associated with maintenance. Knowing how routine maintenance actions can avoid and minimize impacts is also necessary. This may be explored at a regional or valley-wide level in coordination with local, State, and federal permitting agencies. Once the definition is established, regulations may need to be modified or new regional permitting processes created to support timely and effective implementation of required maintenance activities. The permitting processes needs to be developed to facilitate the necessary permitting for maintenance work to preserve design flow and levee integrity while enhancing environmental resources, through coordination, collaboration and cooperative working relationships with all stakeholders and interested parties. This process should identify where environmental clearance and permitting processes can be made more efficient while still meeting state and federal safety standards and following state and federal environmental protection procedures. Below are some options: 1. Increasing the duration over which the permits are valid to reduce costs and to promote more proactive maintenance (particularly in areas or locations that require more frequent maintenance). Various agencies, including the California Department of Fish and Game, U.S. Army Corps of Engineers (USACE), and the Central Valley Regional Water Quality Control Board, already encourage or have mechanisms for multi-year permits for routine activities. However, local levee maintaining agencies are often unaware of these options or have difficulty funding the up-front costs required to obtain longer-duration permits. For example, a new USACE regional permit could be created or Letters of Permission (LOP) issued for operation and maintenance activities to be renewed every 5 years in concert with other federal or State permits. 2. Establishing an interagency permitting office or clearinghouse could help improve the review, frequency of inspection, and enforcement of encroachment permits and permit violations to ensure consistency with system objectives while enhancing local compliance .3. Providing habitat restoration above and beyond what is necessary for project impacts could assist in streamlining future mitigation needs as would developing and implementing a Regional Advanced Mitigation Program that forecasts mitigation needs for routine maintenance and other project impacts and provides the necessary mitigation in advance of the need. Collaboration of all permitting agencies in the RAMP could ensure permit streamlining. 4. Developing corridor management strategies (CMS) for long-term integrated plans to improve and coordinate flood operations, maintenance activities, and ecosystem needs for a certain river reach(s) or corridor.

CVFPP Goals

Contributes Significantly to: Improve Institutional Support

Potentially Contributes to (Check all that apply):

☐ Improve Flood Risk Management
☑ Improve Operation and Maintenance
☐ Promote Ecosystem Functions
☑ Improve Institutional Support
☐ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retain for further evaluation

Advantages:

• Low Capital Cost for O&M will reduce maintenance and repair costs for LMA's.
• Initial costs for permitting and mitigation could be high, but mitigation and permitting costs may decrease in the long-run.

Disadvantages:

• Requires channel and floodways to be evaluated as a whole and consideration of cumulated impacts that could be beyond the resources of LMAs.
• State leadership required. May require coordination from various agencies for system wide projects, or regional projects that cross jurisdictions.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Low; policy actions will tend to have a substantially lower capital cost than actions involving physical construction

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

A streamlined permitting process has the potential to reduce long-term maintenance and repair costs (after the initial cost to provide the advanced mitigation)

Potential for Cost-Sharing?

Cost to implement could be shared among various local, State, and federal agencies

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Would decrease emergency cost by allowing for more for more maintenance work to be accomplished and reduce the impact of emergency efforts significantly over the entire system.

Flood fighting? (Increase, Decrease, or No Significant Change)

Once implemented would allow for more maintenance work to be accomplished and reduce the impact of flood flows significantly over the entire system.

Effect on Damage to Critical Public Infrastructure?

Once implemented would allow for more maintenance work to be accomplished and would reduce the impact of flood flows impact on infrastructure significantly over the entire system.

Effect on Floodplain and Economic Development?

As existing floodplains will most likely provide the habitat, or agricultural lands necessary to acquire and restore or enhance, establishing large areas as mitigation banks for future projects could preclude the ability for urban development with in the floodplain.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

If development cannot occur in the floodplain due to the establishment of conservation or mitigation banks, then the State's Flood Responsibility cannot increase in the future.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

Use of streamlined permitting could allow for mitigation that allows for rehabilitation of ecological functions, by implementing mitigation in larger consolidated areas, in advance of impacts, and in more suitable areas than with piecemeal mitigation.

Adverse Environmental Impact?

None

Permitting Considerations?

Requires changes to existing policies and procedures. A reduction in the number of permits could result in the reduction in workload of permitting agencies.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

Would directly contribute to reducing adverse impacts associated with flood management projects and activities

Social Considerations:

Public Safety?

Promotes consistent and sustainable operation and maintenance of the flood protection work and thereby reduces the risk of floods.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Improving the success of mitigation has the potential to indirectly contribute to water quality, groundwater recharge or recreation benefits

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Initial development of a new permitting strategy would require intense coordination and commitment by multiple agencies; however, once streamlined and/or programmatic permitting mechanisms are established, flood system maintenance activities would be more timely and cost-effective for all parties involved.

Technical Considerations:

Redirected Hydraulic Impacts?

Residual Risk?

A streamlined process is likely to preserve maintenance funds for maintenance, not redirecting them for permitting costs. The net result is a more reliable and better maintained levee. Regular and consistent maintenance of levees and channels will improve the response of the flood protection works and thereby lower systemic risks of flooding.

Climate Change Adaptability:

Would indirectly contribute to climate change adaptability by encouraging or facilitation more successful and sustainable mitigation. In 2008 DWR published a white paper: Managing an Uncertain Future: Climate Change Adaptation Strategies for California's Water in which they identified 10 strategies designed to improve California's ability to cope with a changing climate. Strategy #5 is to enhance and sustain ecosystems. Restoration of floodplain habitats, riverine habitats and riparian habitats will directly improve the amount of carbon sequestration and assist the Department in realizing this goal.

Urban, Small Community, and Non-Urban Considerations:

Potential cost saving benefits to small and non-urban community with limited maintenance budgets.

Regional Applicability:

Potentially applicable to all regions

Integration with Other Programs:

Channel Maintenance Program (FMO) Levee Operations and Maintenance Program (FMO) Environmental Initiative Program (FMO)

References:

RCR; Agricultural Stewardship White Paper;

DRAFT Management Action Evaluation

Management Action Title: MA-057

Encourage multi-jurisdictional and regional partnerships on flood planning and improve agency coordination on flood management activities, including operation and maintenance, repair, and restoration

Description:

Problem:

Flood management is often complicated by the large number of agencies and entities involved, and their complex jurisdictional roles and responsibilities. Overlapping jurisdictions across various federal and State agencies involved in flood management can lead to inconsistent policies and regulations, conflicting guidance, or inefficiencies in planning and implementing projects. Coordinating activities within this fragmented jurisdictional landscape can be challenging, particularly for local entities with limited resources.

Desired Outcome:

Promote streamlined, efficient, and cost-effectiveness flood management through greater coordination.

Methodology:

Coordination between agencies and responsible parties could take many forms, including roundtable discussions, oversight committees, interagency liaisons, repurposed agencies, or new entities. Improving coordination and cooperation might involve establishment of a new institutional framework, such as a system-wide, continuous, integrated group of responsible entities/agencies to oversee and coordinate flood protection, operations and maintenance. Another method would be to establish a single entity or resource with oversight responsibilities to streamline and provide guidelines for all planning, construction, maintenance, repair and restoration activities associated with flood management. With respect to emergency planning and response, a multi-agency coordination system could be developed for jurisdictions in the Central Valley and Delta to improve regional coordination, incident prioritization, and resource management in a major flood. Recommendations for institutional changes or practices could be developed as part of a floodplain management advisory committee composed of local and State government representatives, floodplain managers, and other stakeholders. The benefits of improved coordination could include streamlined permitting and approval processes; more efficient and cost-effective routine maintenance and repairs; more successful and sustainable environmental mitigation through regional coordination with conservation efforts; better leveraging of available funding sources; and flood management projects that provide multiple, mutual benefits.

CVFPP Goals

Contributes Significantly to: Improve Institutional Support

Potentially Contributes to (Check all that apply):

- ☐ Improve Flood Risk Management
- ☑ Improve Institutional Support
- ☑ Improve Operation and Maintenance
- ☑ Promote Multi-Benefit Projects
- ☑ Promote Ecosystem Functions

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained for further evaluation

Advantages:

- Potential to improve efficiency and effectiveness of a broad range of flood management activities (maintenance, repairs, restoration and conservation).
- Low initial investment cost

Disadvantages:

- May require changes to the purpose or responsibilities of existing institutions.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Low initial investment cost compared with structural measures

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Potential to decrease O&M costs through streamlining and improving regional coordination

Potential for Cost-Sharing?

Potential for costs to be spread across multiple agencies and jurisdictions to meet mutual goals and objectives

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Potential to increase the efficiency and effectiveness of emergency planning, response, and recovery efforts

Flood fighting? (Increase, Decrease, or No Significant Change)

Potential to improve the cost-effectiveness of flood fighting by increasing efficiency and reducing overlapping .

Effect on Damage to Critical Public Infrastructure?

No direct effects

Effect on Floodplain and Economic Development?

No direct effects

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

No direct effects, but improving coordination could indirectly facilitate more effective O&M and timely implementation projects to reduce flood liabilities.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

No direct effects; however, improved coordination could foster integration of mitigation, restoration, and conservation activities across multiple agencies and jurisdictions, resulting in more successful rehabilitation of ecosystem functions (consolidating mitigation efforts within regions, implementing mitigation in advance of impacts, and selecting more suitable lands for mitigation)

Adverse Environmental Impact?

None

Permitting Considerations?

None

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

Potential to improve the efficiency and effectiveness of mitigation associated with flood system maintenance and repairs

Social Considerations:

Public Safety?

No direct effects; however, improved coordination would indirectly improve public safety by facilitating more efficient, cost effective, and timely operation, maintenance, and repair activities and new project implementation

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Coordination across agencies and jurisdictions could promote multi-benefit projects that meet mutual goals and objectives

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

May be difficult to sustain coordination over the long-term; individual agencies may be unwilling or unable to participate due to cost or governance structure

Technical Considerations:

Redirected Hydraulic Impacts?

No direct effects

Residual Risk?

No direct effects. However, greater coordination of floodplain management activities would reduce residual risk

Climate Change Adaptability:

Potential to enhance biological adaptability by increasing the connectivity and complexity of mitigation habitats, and their continuity along environmental gradients, thus, increasing the ability of species to adjust to the consequences of climate change

Urban, Small Community, and Non-Urban Considerations:

No specific considerations identified

Regional Applicability:

Applicable to all regions

Integration with Other Programs:

Corridor Management Strategy (FMO); Flood Projects Office; Federal, State and local programs, policies and regulations including mapping, building codes, emergency response, general plans

References:

RCR; Environmental Sustainability Summary; CCVFCA White Paper: Flood Protection and Risk Management in the Sacramento Valley, 2008, First Step White Paper; California Floodplain Management Task Force, 2002, Final Recommendations Report;http://biodiversity.ca.gov/; http://www.carangeland.org/http://www.centralvalleyjointventure.org/

DRAFT Management Action Evaluation

Management Action Title: MA-058

Develop State criteria and processes for urban flood protection.

Description:

Problem:

State law enacted in 2007 (Senate Bill (SB) 5) calls for urban and urbanizing areas in the Sacramento-San Joaquin Valley to achieve a minimum of 200-year (0.5% annual chance) flood protection by 2025. However, the necessary set of criteria does not exist for evaluating whether existing or new levees are consistent with this urban level of protection (Government Code § 65865.5, 65962, 66474.5). SB 5 requires that the urban level of flood protection be consistent with criteria used or developed by DWR (Government Code § 65007(k)). To avoid delaying urgently needed flood protection, California needs interim levee design criteria that fulfill this requirement until the criteria are revised by DWR and/or adopted as regulations.

DWR reviewed current guidance and levee criteria by the Corps and FEMA. With the exception of hydrologic, hydraulic, and levee freeboard requirements FEMA's levee design guidance contains no specific criteria and suggests use of various Corps documents. The Corps has developed most of the guidance needed for engineers to design levee systems, and most engineers involved in levee design and construction utilize that guidance. However, some important aspects of the Corps' guidance lack specificity, need to be modified, or are still under development including criteria for frequently loaded levees and seismic vulnerability. New advances in geotechnical evaluation and exploration are not captured by the existing guidance. A robust set of criteria for evaluating existing and new levees is needed for California. Furthermore, there are no procedural criteria that would be applicable for engineers, cities, or counties in making a finding that the urban level of flood protection exists for an area.

Due to the changing state of practice and the absence of specific guidance from the Federal government on some levee design considerations, the State needs to provide interim guidance and criteria for design water surface elevations and levee design that will be used for:(1)Evaluations of Project levees in urban and urbanizing areas; (2)Evaluations of urban and urbanizing area levees that are not part of the State-Federal flood protection system (i.e., non-project levees); (3)Guidance for urban and urbanizing area levee designs to be initiated/completed in the near future; (4) Eligibility criteria for urban Early Implementation Program grant funding; (5) Assisting local agencies in achieving FEMA 100-year flood protection; (6) Assisting local agencies in achieving the urban level of flood protection; (7)Planning studies, such as the Central Valley Flood Protection Plan.

Desired Outcome:

A robust and well-accepted evaluation and design criteria for urban levees, floodwalls and other flood control structures that comprise the SPFC, including appurtenant, non-project flood control structures.

Methodology:

DWR must develop both 1) evaluation and design criteria and 2) procedures and guidance to that will allow urban and urbanizing areas to meet the requirements of SB5.

CVFPP Goals

Contributes Significantly to: Improve Institutional Support

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☑ Improve Operation and Maintenance
- ☑ Promote Ecosystem Functions
- ☑ Improve Institutional Support
- ☑ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retain for further consideration

Advantages:

- Ensures that consistent levels of protection.

Disadvantages:

- High implementation cost.

• Reduces State liability for flood damages.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Development requires low capital costs. However, implementation costs will be high.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Development has no direct impact on O&M costs, although implementation would potentially increase O&M costs.

Potential for Cost-Sharing?

Potential to develop standards in cooperation with USACE and FEMA. FEMA's involvement in developing the standards is also being sought by DWR, although the USACE has been more involved to date.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Implementation may reduce the frequency of flooding, thereby reducing the long-term costs of emergency response and recovery. However, it would not necessarily decrease the consequences.

Flood fighting? (Increase, Decrease, or No Significant Change)

Implementation reduces the long-term costs of flood fighting.

Effect on Damage to Critical Public Infrastructure?

May reduce damage to critical infrastructure due to decrease in frequency of flooding.

Effect on Floodplain and Economic Development?

May support or encourage floodplain development.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Implementation reduces the frequency of flooding; thereby reducing State financial responsibility.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

None

Adverse Environmental Impact?

Implementation results in further system improvements, which may have positive and/or adverse environmental impact.

Permitting Considerations?

Implementation will result in further system improvements, which may require additional permits.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Implementation will improve public safety by reducing the frequency of flooding.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to provide greater water supply reliability, recreation and open space.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

High likelihood due to SB5; will require broad agreement from technical stakeholders.

Technical Considerations:

Redirected Hydraulic Impacts?

Standards will address any potential redirected hydraulic impacts.

Residual Risk?

May reduce residual risk to existing urban areas; may increase risk if floodplain development is encouraged (i.e., urbanizing areas).

Climate Change Adaptability:

This action is unrelated to hydrologic and biological adaptability.

Urban, Small Community, and Non-Urban Considerations:

Applicable to urban (and urbanizing) land uses only.

Regional Applicability:

Applicable to all regions

Integration with Other Programs:

Interim Levee Design Criteria for Urban and Urbanizing State-Federal Project Levees; Levee Evaluations Program; Levee Repairs Program

References:

Framework for SAFCA's Participation in Formulating the CVFPP: Information Item, 2009;

DRAFT Management Action Evaluation

Management Action Title: MA-059

Increase funding for flood management projects by leveraging Federal funding.

Description:

Problem:

Current federal, State, and local funding mechanisms are not adequate to sustain effective flood management.

Desired Outcome:

Maximize available funding for flood management projects.

Methodology:

Projects could be planned and developed specifically to leverage funding from multiple federal sources, including the Federal Emergency Management Agency (FEMA), National Flood Insurance Program (NFIP), Natural Resource Conservation Service (NRCS), Fish and Wildlife Service (USFWS), and the USACE. This might include development of multi-benefit projects that leverage funding for a variety of federal project purposes (flood risk reduction, environmental restoration, hazard mitigation, water supply, water quality, others), or development of projects that incorporate both structural and non-structural actions addressing flood risk reduction as well as mitigation once flooding occurs.

CVFPP Goals

Contributes Significantly to: Improve Institutional Support

Potentially Contributes to (Check all that apply):

- ☐ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☑ Improve Institutional Support
- ☐ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained.

Advantages:

- Low cost to implement for the potential benefits gained.
- More federal funding could reduce the impact on level of State funding necessary to carry out the necessary flood projects.

Disadvantages:

- Federal cost sharing percentage for flood management has reduced over the past decade.
- May require changes to federal cost sharing laws or appropriations to realize significant benefits.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Low to no cost to implement

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

O&M costs would not change

Potential for Cost-Sharing?

Federal cost sharing has been reduced from 75 to 65% in recent years; even if projects are formulated specifically to promote federal interests, federal appropriations may remain low

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

No direct effects on emergency response and recovery

Flood fighting? (Increase, Decrease, or No Significant Change)

No direct effects on flood fighting

Effect on Damage to Critical Public Infrastructure?

No direct effects, but protection of public infrastructure could be improved over the long-term if more funding is made available to improve the flood management system. Faster improvement of flood management facilities would reduce the infrastructure damage.

Effect on Floodplain and Economic Development?

No direct effect, but improvements to the flood management system and level of protection provided could encourage additional floodplain development

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

No direct effects, provided flood management improvement projects do not expand State flood responsibilities

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

None

Adverse Environmental Impact?

None

Permitting Considerations?

None

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

No direct effects, but increased funding for improvements would result in a flood management system that provides greater public safety

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

No direct effects

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Potential for broad public support; may require changes to laws or regulations at a Federal level (cost sharing and/or appropriations); may require new Federal programs

Technical Considerations:

Redirected Hydraulic Impacts?

None

Residual Risk?

No direct effect on residual risk

Climate Change Adaptability:

No direct effects

Urban, Small Community, and Non-Urban Considerations:

No specific considerations identified

Regional Applicability:

Applicable to all regions.

Integration with Other Programs:

Federal Grants Technical Support (LRFMO), Flood Projects Office (FPO)

References:

RCR;

DRAFT Management Action Evaluation

Management Action Title: MA-060

Leverage funding from multiple projects to improve cost- effectiveness and efficiency of flood management projects.

Description:

Problem:

IThere are often numerous projects occurring simultaneously in the same region, all of which conduct planning, design, permitting, and mitigation activities independent of each other. This could result in duplicate efforts and the potential for missed opportunities to provide mutual benefits.

Desired Outcome:

Improve the cost effectiveness and financial feasibility of individual flood management projects by consolidating projects on a regional or systemwide level.

Methodology:

GAlign new infrastructure projects, such as setback levees, with other existing or planned infrastructure projects (such as roads or highways) to leverage funding from multiple agencies, increase construction and maintenance efficiency, combine mitigation efforts, and accomplish multiple objectives. Consolidating and coordinating planning and design activities could increase cost effectiveness, highlight opportunities to provide mutual benefits or multiple benefits beyond those planned as part of individual projects, improve the effectiveness and sustainability of mitigation activities, and leverage funding and implementation support from multiple sources.

CVFPP Goals

Contributes Significantly to: Improve Institutional Support

Potentially Contributes to (Check all that apply):

- ☐ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☑ Improve Institutional Support
- ☑ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retain for further evaluation

Advantages:

- Low cost to implement for the potential benefits gained like shared data and information and eliminating duplications.
- Potential to improve cost effectiveness of improvements.

Disadvantages:

- May require coordination across multiple agencies and jurisdictions.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Low cost to implement.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

O&M cost would not change.

Potential for Cost-Sharing?

Projects that provide regional benefits and address the interests of multiple partners may be more cost-effective and successful in generating funding from a variety of sources. Utilizing all various source of data and information could reduce the cost of a study or project.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

No direct effects on emergency response and recovery.

Flood fighting? (Increase, Decrease, or No Significant Change)

No direct effects on flood fighting.

Effect on Damage to Critical Public Infrastructure?

No direct effects on public infrastructure; however, flood management projects that incorporate improvements to transportation or other public infrastructure may provide increased funding opportunities.

Effect on Floodplain and Economic Development?

No direct effect, but improvements to the flood management system and level of protection provided could encourage additional floodplain development.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

No direct effects.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

Key physical processes and ecosystem functions could be rehabilitated by combining funding requests of ecosystem restoration projects with flood management projects, increasing the likelihood for funding of both.

Adverse Environmental Impact?

None

Permitting Considerations?

None

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

No direct effects, but increased funding for improvements would result in a flood management system that provides greater public safety.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

No direct effects.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Potential for broad public support; would require increased coordination at State, federal, and regional levels.

Technical Considerations:

Redirected Hydraulic Impacts?

None

Residual Risk?

No direct effect on residual risk.

Climate Change Adaptability:

None

Urban, Small Community, and Non-Urban Considerations:

May provide a means for small communities or rural areas that are unable to fund or justify projects on their own, to receive flood benefits as part of larger, regional projects.

Regional Applicability:

All regions

Integration with Other Programs:

Flood Projects Office (FPO).

References:

Environmental Sustainability Summary; Framework for SAFCA's Participation in Formulating the CVFPP: Information Item;

DRAFT Management Action Evaluation

Management Action Title: MA-061

Create a bank or other financial mechanism that pre-funds both O&M and mitigation activities.

Description:

Problem:

Lack of funding can curtail effective environmental mitigation for routine operation and maintenance (O&M) of the flood management system. One view holds that the current process for obtaining permits and mitigating potential O&M impacts can exceed the budgets and resources of some levee maintaining agencies (LMA). Most LMAs have limited funding sources and some have expressed that they are spending an increasingly larger portion of their operating budget and time obtaining permits, often involving coordination with multiple agencies, to perform required maintenance activities. Others contend that traditional O&M funding mechanisms were established during a time when maintenance activities were less sensitive to environmental impacts and did not consider the costs associated with O&M today. The concept of sustainable and equitable funding for operating and maintaining the flood protection system in perpetuity is very important. Currently there are many shapes and sizes of levee maintaining agencies. Each entity has its own challenges in obtaining funding.

Desired Outcome:

Improve the efficiency and cost-effectiveness of flood system O&M and associated mitigation.

Methodology:

When cost estimating is completed for a repair project or ongoing O&M activity, sufficient funds should be set aside for environmental mitigation. Funding for mitigation and O&M activities could be combined if planned in the early stages of a project. Creating a bank or other financial mechanism that pre-funds both O&M and mitigation would help improve the efficiency and cost effectiveness of both activities, and make sure that lack of funding does not hamper achievement of mitigation goals.

CVFPP Goals

Contributes Significantly to: Improve Institutional Support

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☑ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☑ Improve Institutional Support
- ☐ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained; requires further investigation

Advantages:

- Low cost to implement and maintain over time.
- Potential long-term benefits to both flood management and environmental sustainability.

Disadvantages:

- May be difficult to delineate jurisdictional responsibilities and identify appropriate institution to manage the funding bank.
- Funding bank may not be sustainable without changes to LMA revenue generation.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Low initial cost to implement

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Could potentially reduce annual O&M costs by improving efficiency

Potential for Cost-Sharing?

Potential for cost-sharing via federal funding or State grant funds

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Improving O&M could contribute to reducing emergency response and recovery costs

Flood fighting? (Increase, Decrease, or No Significant Change)

Improving O&M could contribute to reducing flood fighting

Effect on Damage to Critical Public Infrastructure?

No direct effects on public infrastructure

Effect on Floodplain and Economic Development?

No direct effect

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential to reduce State flood responsibility by improving the cost effectiveness of O&M

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

Improving funding mechanisms for mitigation could improve the cost-effectiveness of mitigation activities throughout the flood management system.

Adverse Environmental Impact?

None

Permitting Considerations?

None

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

High potential to reduce conflicts between O&M and environmental values

Social Considerations:

Public Safety?

No direct effects, but improving O&M could contribute to improving public safety

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

None

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Jurisdictional and institutional roles and responsibilities would need to be established; appropriate management and oversight for the funding bank would need to be identified; may require changes to existing laws or regulations governing funding for O&M and other flood management activities

Technical Considerations:

Redirected Hydraulic Impacts?

None

Residual Risk?

No direct effects on residual risk

Climate Change Adaptability:

Improving the effectiveness and efficiency of mitigation for O&M activities could improve overall environmental sustainability

and resilience under altered climate conditions

Urban, Small Community, and Non-Urban Considerations:

No specific considerations identified

Regional Applicability:

Applicable to all regions.

Integration with Other Programs:

References:

CCVFCA White Paper: Flood Protection and Risk Management in the Sacramento Valley, 2008, First Step White Paper.

DRAFT Management Action Evaluation

Management Action Title: MA-062

Explore alternative funding for O&M and new flood management improvements.

Description:

Problem:

Current State and local funding mechanisms are not sufficient in many cases to adequately sustain effective flood management. Investment in flood management has declined in recent years at all levels of government. Public funds available through various State grant, loan, and bond programs have helped bridge funding gaps for many local improvement projects. However, funding for these State programs has varied over time and is limited by budget constraints and political subjectivity. Federal cost sharing for flood management projects dropped from 75 percent to 65 percent in recent years. Further, local entities are often responsible for funding large portions of projects that provide significant regional or statewide benefits (economic, social, cultural benefits).

Desired Outcome:

Develop sustainable funding for flood system O&M and new flood management construction.

Methodology:

There are many opportunities for funding flood management actions and improvements outside of traditional taxes, bond funding, and grants. Alternate sources of funding should be considered for flood project implementation, including non-governmental organizations (NGO), local or regional funding groups, or recreation fees. For example, there may be opportunities to collect fees from areas that share in the regional or statewide benefits provided by a robust flood management system but do not directly receive flood protection.

CVFPP Goals

Contributes Significantly to: Improve Institutional Support

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☑ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☑ Improve Institutional Support
- ☐ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained, requires further investigation

Advantages:

• Sustainable funding would provide real and lasting benefits to all aspects of flood management

Disadvantages:

• May be difficult to change laws or regulations governing revenue generation.
• Sustainable funding is a significant issue now and will continue to be so into the future.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Low initial cost to implement

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

O&M costs would not change

Potential for Cost-Sharing?

New or improved cost sharing mechanisms could be incorporated into this management action

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Improving O&M could contribute to reducing emergency response and recovery costs

Flood fighting? (Increase, Decrease, or No Significant Change)

No direct effects; improving O&M could improve the reliability of the flood management system, indirectly reducing flood fighting

Effect on Damage to Critical Public Infrastructure?

No direct effects on public infrastructure

Effect on Floodplain and Economic Development?

No direct effect

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential to reduce State flood responsibility by improving the cost effectiveness of O&M

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

None

Adverse Environmental Impact?

None

Permitting Considerations?

None

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

High potential to reduce conflicts between O&M and environmental values

Social Considerations:

Public Safety?

No direct effects, but improving O&M could contribute to improving public safety

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

None

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Jurisdictional and institutional roles and responsibilities would need to be established, depending on the mechanism; may require changes to existing laws or regulations governing funding and revenue generation for O&M and other flood management activities

Technical Considerations:

Redirected Hydraulic Impacts?

None

Residual Risk?

No direct effects on residual risk

Climate Change Adaptability:

No direct effects

Urban, Small Community, and Non-Urban Considerations:

No specific considerations identified

Regional Applicability:

Applicable to all regions.

Integration with Other Programs:

References:

Environmental Sustainability Summary; RCR; California Floodplain Management Task Force, 2002, Final Recommendations Report

DRAFT Management Action Evaluation

Management Action Title: MA-063

Coordinate flood response planning and clarify roles and responsibilities related to flood preparedness and emergency response.

Description:

Problem:

Unclear roles for local (city and county) and State agencies in supporting floodfight operations can impede quick and effective floodfighting during a major flood event. Some agencies and organizations charged with responding in the field during a flood emergency lack the capacity, resources, and interagency coordination necessary to carry out these duties effectively. Due to the long length of time between major floods, only a limited number of emergency response staff have significant flood response experience, technical expertise, or local understanding. This is also related to limited conduct or participation in emergency response exercises between flood events. Further, there is infrequent coordination between agencies and limited ability to advance new technologies and science related to levee breaches and floodfighting.

Desired Outcome:

Reduce the consequences of flooding by clarifying roles and responsibilities, improving training and the capacity of emergency response staff, and increasing coordination at all levels of government.

Methodology:

This management action could include a broad range of tactics at the state and local levels to clarify roles, increase communication, and improve the effectiveness of response to floods. These tactics could include promoting flood contingency and response planning at local and regional levels, and establishing a team to review current regional and local flood emergency procedures, response capacities, and communication capabilities for potential updates and improvements. Maintenance System Specialist committees could be reconvened to review and update Flood Emergency Action Team (FEAT) guidance documents and recommendations, in coordination with CalEMA. DWR could refine and clarify staff assignments and responsibilities related to flood fighting and emergency response, and put mechanisms in place to facilitate payment of vendors. Actions could also be taken to advance the science and awareness of rapid levee breach repair methods to facilitate repairs and speed recovery efforts. Joint field training exercises and briefings, in conjunction with CalEMA, could be facilitated to test and refine response procedures, communications, and logistics, and educate response staff.

CVFPP Goals

Contributes Significantly to: Improve Institutional Support

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☑ Improve Institutional Support
- ☐ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retain for further evaluation.

Advantages:

- Low Capital Cost.
- Will reduce long-term emergency response costs due to economies of scale and increased coordination.

Disadvantages:

- Establishing a clear and shared understanding of roles and responsibilities at all government levels may be difficult.
- Funding for local emergency response agencies has been challenging.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Low to medium. Policy MAs will tend to have a substantially lower capital cost than other MAs that involve physical construction. Example of capital investments include: funding for planning activities, communication system upgrades, joint training exercises, etc.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

No significant change.

Potential for Cost-Sharing?

Yes. Potential cost-sharing with LMAs and local governments, State, and federal agencies for pre-flood emergency response and contingency planning.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Decrease. Improved emergency response planning would facilitate consistent and timely response during flooding events, which could reduce potential flood damages and recovery needs. Improved communication would increase response efficiency and effectiveness.

Flood fighting? (Increase, Decrease, or No Significant Change)

This MA contributes to effective and cost efficient floodfighting by improving communication, technology, and training and leveraging regional response capabilities.

Effect on Damage to Critical Public Infrastructure?

No significant change.

Effect on Floodplain and Economic Development?

No significant change.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential decrease. Improved flood preparedness could reduce the consequences of flooding, and more successful floodfighting has the potential to reduce the levee breaches and the subsequent frequency of flooding.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

None

Adverse Environmental Impact?

None

Permitting Considerations?

None

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Improves public safety by reducing consequences when flooding occurs. Better coordination and planning among all emergency responders ensures faster and more effective response (flood warning, evacuations, etc.).

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

None.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

High potential for political and public support; institutionally, support also exists, though opinions on how to implement and

fund these actions likely differ. Establishing a clear and shared understanding of roles and responsibilities at all government levels may be difficult. Local agency participation may be affected by lack of funding.

Technical Considerations:

Redirected Hydraulic Impacts?

None.

Residual Risk?

Reduces residual risk. Improving emergency response planning reduces consequences of flooding (potential damages to life and property).

Climate Change Adaptability:

This action is unrelated to hydrologic and biological adaptability.

Urban, Small Community, and Non-Urban Considerations:

Emergency response planning is equally important to urban, small, and non-urban communities. The need for improvement varies. There is greater opportunity for making improvements in non-urban areas relative to urban areas.

Regional Applicability:

All regions, though Delta as special needs because of access and egress issues.

Integration with Other Programs:

DWR: Statewide Emergency Operations Plans (HAFOO), DWR Delta Flood Emergency Preparedness and Response Plan (HAFOO), Delta Emergency Operation Plan (HAFOO). Federal: FEMA, USACE, and other federal disaster assistance programs.

References:

USACE 2001 Sacramento and San Joaquin River Basins Comprehensive Study; Flood Warning: Responding to California's Flood Crisis.; RCR; Agricultural Stewardship White Paper;

DRAFT Management Action Evaluation

Management Action Title: MA-064

Improve communication and public awareness of emergency response procedures and terminology.

Description:

Problem:

The public's response to any emergency is based on an understanding of the nature of the emergency, the potential hazards, the likely response of emergency services, and knowledge of what individuals and groups should do to increase their chances of survival and recovery. Public awareness and education prior to a flood emergency directly affects emergency response and recovery efforts. There is a need to educate the public on potential flood risks and how they should respond in a flood emergency.

Desired Outcome:

Through education, there is an opportunity to reduce loss of life from flooding and facilitate effective evacuation.

Methodology:

Effective hazard communication plans should be developed that use standardized evacuation terminology, and these plans should effectively communicated to the public. For instance, DWR could create simple, standardized flood threat levels (Flood Threat Condition 1 through 4, for example) for flood threat monitoring and management to assign appropriate flood response levels; these standardized flood threat levels could also be easily displayed on maps and used in public media advisories. Public outreach meetings could be conducted to notify property owners of flood risks, safety measures, and evacuation routes.

CVFPP Goals

Contributes Significantly to: Improve Institutional Support

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☑ Improve Institutional Support
- ☐ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retain for further evaluation. Should investigate combining with other consolidated MAs in this category. State participation in this MA (funding, coordination, planning assistance) should not constitute State responsibility for implementation activities and their effects.

Advantages:

- Low capital cost.
- Reduces long-term emergency response costs.
- Education may lead to more informed decisions and reduced residual risk.

Disadvantages:

- Small or non-urban communities may have limited funding and institutional capacity.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Low. Policy MAs tend to have a substantially lower capital cost than other MAs which involve physical construction.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

No significant change.

Potential for Cost-Sharing?

Yes. Potential cost-sharing with local governments for developing hazard communication plans and conducting education

outreach meetings.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Decrease. Improved communication and public awareness of emergency response procedures and terminology would reduce potential for damages and need for recovery.

Flood fighting? (Increase, Decrease, or No Significant Change)

No change. This MA contributes to flood emergency response but not to flood fighting coordination.

Effect on Damage to Critical Public Infrastructure?

No significant change.

Effect on Floodplain and Economic Development?

Potential decrease. Educating the public on flood risks could help discourage support for development in flood prone areas.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Decrease. Improved communication and public awareness would reduce the consequences of flooding and thereby reduce State Flood responsibility.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

None

Adverse Environmental Impact?

None

Permitting Considerations?

None

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Potentially improves public safety by increasing public awareness of flood emergency response.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Improved flood response may protect nearby resources.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Politically and publicly acceptable at the State, regional, and local levels. Some smaller local governments may be limited in their funding and institutional capacity to create hazard communication plans and education outreach without additional assistance.

Technical Considerations:

Redirected Hydraulic Impacts?

None.

Residual Risk?

None.

Climate Change Adaptability:

Unrelated to hydrologic and biological adaptability.

Urban, Small Community, and Non-Urban Considerations:

Small or non-urban communities may have limited funding and institutional capacity to create hazard communication plans and education outreach without additional assistance.

Regional Applicability:

All regions.

Integration with Other Programs:

References:

USACE 2001 Sacramento and San Joaquin River Basins Comprehensive Study;

DRAFT Management Action Evaluation

Management Action Title: MA-065

Establish standard flood warning systems and procedures.

Description:

Problem:

Warning affected citizens when a flood emergency is occurring or is imminent promotes public safety. Effective plans to alert the public of personal protective actions they can takecurrently exist in areas of the Central Valley. However, there are opportunities to enhance these plans. While some jurisdictions have established flood warning systems and procedures, other jurisdictions lack them completely. This can cause confusion among the public when responding to a flood emergency.

Desired Outcome:

This management action would increase public awareness of flood emergencies and increase time for the public to implement home and business emergency actions.

Methodology:

In coordination with existing systems, establish enhanced standard flood warning procedures, terminology and install warning systems that can be easily and quickly implemented by any 90% of communities greater than 1,000 people by 2025.

CVFPP Goals

Contributes Significantly to: Improve Institutional Support

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☑ Improve Institutional Support
- ☐ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retain for further evaluation

Advantages:

- Low capital cost.
- Would help reduce loss of life from flooding.
- Would help reduce emergency response costs.

Disadvantages:

- Small or non-urban communities may have limited funding and institutional capacity to create and adopt standard warning systems and procedures.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Low. Policy MAs will tend to have a substantially lower capital cost than other MAs which involve physical construction.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

No significant change.

Potential for Cost-Sharing?

Yes. Potential cost-sharing with LMAs and local governments for flood warning systems; federal cost sharing is uncertain under current federal grant/funding opportunities.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Decrease. Improved flood warning systems and procedures would increase public awareness and preparedness of personal protective actions they can take to respond to flood emergencies.

Flood fighting? (Increase, Decrease, or No Significant Change)

No significant change.

Effect on Damage to Critical Public Infrastructure?

Region specific. Some communities without flood warning systems and procedures would likely experience reduced damage to critical public infrastructure due to more coordinated emergency response activities. Communities already with warning systems and procedures in place may not experience a change in damage on critical public infrastructure.

Effect on Floodplain and Economic Development?

No significant change.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Decrease. Potential to decrease State responsibility by reducing the consequences of flooding.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

None

Adverse Environmental Impact?

None

Permitting Considerations?

None

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Providing early flood warning and notification would improve public safety.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

None.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Likely to be politically acceptable at the State and local levels. Some smaller local governments may be limited in their funding and institutional capacity to adopt standard flood warning systems and procedures.

Technical Considerations:

Redirected Hydraulic Impacts?

None.

Residual Risk?

Reduces residual risk by reducing the consequences of flooding.

Climate Change Adaptability:

Unrelated to hydrologic and biological adaptability.

Urban, Small Community, and Non-Urban Considerations:

Small or non-urban communities may have limited funding and institutional capacity to create and adopt standard warning systems and procedures.

Regional Applicability:

All regions.

Integration with Other Programs:

Joint DWR/NWS Flood Warning Program (HAFOO)

References:

Flood Warning: Responding to California's Flood Crisis.; California Floodplain Management Task Force, 2002, Final Recommendations Report; USACE 2001 Sacramento and San Joaquin River Basins Comprehensive Study

DRAFT Management Action Evaluation

Management Action Title: MA-066

Improve stream gage network for forecasting purposes.

Description:

Problem:

Flood forecasting models are limited, in part, by the quantity and quality of available stream gage network data. Additional sensors and stations are needed to improve the quality of flood and reservoir inflow forecasts.

Desired Outcome:

Install additional stream gages and data sensors to improve the quality of flood and reservoir inflow forecasts.

Methodology:

DWR should work with the USGS to install, maintain, and provide priority funding for a comprehensive stream gage network that would improve flood forecasting and monitoring. This network would include real-time gaging and dual path telemetry for river stage, rainfall, and temperature data. Real-time data, its timely availability, and real-time data quantities and quality are all critical data input to the forecasting models and contribute to improving forecasting quality and timeliness.

CVFPP Goals

Contributes Significantly to: Improve Institutional Support

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☑ Improve Institutional Support
- ☐ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retain for further evaluation

Advantages:

- Low Capital Cost.
- High potential for federal cost share.
- Will decrease costs for floodfighting and emergency response and recovery.

Disadvantages:

- Requires significant effort to maintain stream gage network.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Low. Primary capital costs would consist of installing new gaging stations.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Increased O&M costs for the stream gage network. Long-term flood system maintenance costs would decrease slightly due to improved operations from flood forecasting. Reservoir operation costs would increase due to flood forecasting efforts and increased coordination with operators.

Potential for Cost-Sharing?

High potential for Federal cost sharing via contributions to existing federal project purposes (flood control and water supply)

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Decrease. Improved flood forecasting would provide additional time for emergency response activities.

Flood fighting? (Increase, Decrease, or No Significant Change)

With improved flood forecasting, floodfighting activities such as sandbagging, constructing protective ring dikes, relocating valuable property, and evacuations could be coordinated in advance of flood events. Improved forecasting would also assist in prioritization of floodfight activities and other emergency response activities.

Effect on Damage to Critical Public Infrastructure?

Flood forecasting would provide more time for emergency preparedness and response to protect critical public infrastructure.

Effect on Floodplain and Economic Development?

No direct effects; however, could reduce the frequency of flooding, which may encourage development in the floodplain.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Decrease. Potential to decrease State responsibility by reducing the consequences of flooding.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

None

Adverse Environmental Impact?

Improving the stream gage network would result in minor temporary impacts to riparian and aquatic habitat.

Permitting Considerations?

Installation of new stream gage stations may require potentially lengthy permitting.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Improving flood forecasting would provide early warning and notification to flood management system operators to protect public safety.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

None.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Political acceptability would likely be high across all levels of government. Institutional capacity to improve flood forecasting would reside in the State and Federal levels of government.

Technical Considerations:

Redirected Hydraulic Impacts?

None.

Residual Risk?

Reduces residual risk by reducing the consequences of flooding.

Climate Change Adaptability:

This action could enhance hydrologic adaptability by providing data that could increase efficiency and flexibility of flood and water management operations at reservoirs in the system.

Urban, Small Community, and Non-Urban Considerations:

None.

Regional Applicability:

All regions.

Integration with Other Programs:

Forecast-Coordinated Operations Program (HAFOO), Forecast-Based Operations Program (HAFOO), potential integration with river restoration projects/programs (e.g., San Joaquin River restoration programs).

References:

California Floodplain Management Task Force, 2002, Final Recommendations Report; USACE 2001 Sacramento and San Joaquin River Basins Comprehensive Study; Flood Warning: Responding to California's Flood Crisis.;

DRAFT Management Action Evaluation

Management Action Title: MA-067

Implement advanced weather forecast-based operations to increase reservoir management flexibility.

Description:

Problem:

During the flood season, reservoir operators currently follow the Water Control Manual and corresponding Flood Control Diagram developed by USACE for their reservoir operations. Most of the flood control diagrams are based on conditions currently occurring in the reservoir and often do not provide the operational flexibility needed to improve flood protection and water supply. Flood control diagrams also do not take advantage of the most recent advancements in weather and river forecasting and data gathering and exchange to minimize the downstream impacts of reservoir releases.

Desired Outcome:

Forecast-based operations provide operational flexibility based on snow accumulations in the basin, basin wetness, runoff forecasts, quantitative precipitation forecasts, and climate change. Increasing flexibility of operations at flood control reservoirs using advanced forecasting information would be explored for many reservoirs throughout the Central Valley.

Methodology:

Forecast-based operations would provide operators information on future reservoir inflows and would allow them to better save the flood management storage for the peak of the storm to help minimize the risk of exceeding river channel capacity. Knowledge of future flows and reservoir releases would increase the warning times to communities along the rivers and downstream of flood control reservoirs.

CVFPP Goals

Contributes Significantly to: Improve Institutional Support

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☑ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☑ Improve Institutional Support
- ☑ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retain for further evaluation

Advantages:

- Low Capital Cost.
- Will decrease costs for many activities, including flood fighting, emergency response and recovery, and some O&M activities.

Disadvantages:

- Advanced weather forecast based operations are not proven in real-time operations.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Low. Primary capital costs consist of developing weather forecasting and hydrologic models, and coordination with reservoir operators.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Increased O&M costs for the stream gage network. Long-term flood system maintenance costs would decrease slightly due to improved operations from flood forecasting. Reservoir operation costs would increase due to flood forecasting efforts and increased coordination with operators.

Potential for Cost-Sharing?

Yes. Significant potential for local and federal government cost-sharing.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Decrease. Forecast-based operations would facilitate consistent and timely response during flooding, which would reduce potential damage and need for recovery.

Flood fighting? (Increase, Decrease, or No Significant Change)

Decrease. Decreasing peak flows and improving notification processes would decrease long-term flood fighting costs. Forecasting would allow flood fighting efforts to be coordinated in advance of flood events.

Effect on Damage to Critical Public Infrastructure?

Decrease. Decreasing peak flows by operating reservoirs in advance of flood events would reduce damage to critical public infrastructure.

Effect on Floodplain and Economic Development?

No direct effects; however, could reduce the frequency of flooding, which may encourage development in the floodplain.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Decrease. Potential to decrease State responsibility by reducing the frequency and consequences of flooding.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

None

Adverse Environmental Impact?

None

Permitting Considerations?

None

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Decreasing peak flows and improving notification processes would improve public safety.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

While forecast-based operations would be targeted to improve flood control, it could provide more flexibility in managing reservoirs to achieve other benefits (water supply, recreation, ecosystem needs, etc.)

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Forecast-coordinated operations have been developed on the Yuba-Feather River system and are being developed on some San Joaquin river reservoirs. Forecast-coordinated operations have thus proven to be politically and institutionally acceptable in some instances. However, forecast-based operations may face some political and institutional resistance because they could create binding rules that would restrict the flexibility of individual reservoir operators.

Technical Considerations:

Redirected Hydraulic Impacts?

None.

Residual Risk?

Reduces residual risk by reducing the frequency and consequences of flooding.

Climate Change Adaptability:

This action could enhance hydrologic adaptability by providing data that could increase efficiency and flexibility of flood and water management operations at reservoirs in the system.

Urban, Small Community, and Non-Urban Considerations:

None.

Regional Applicability:

All regions.

Integration with Other Programs:

Forecast-Coordinated Operations Program (HAFOO), Forecast-Based Operations Program (HAFOO)

References:

Environmental Sustainability Summary;

DRAFT Management Action Evaluation

Management Action Title: MA-068

Create systemwide levee instrumentation for early warning systems.

Description:

Problem:

Flood emergencies in areas protected by the SPFC usually result from levee breaks. Warning affected citizens is then dependent not only on knowing when a flood peak will occur and how large it will be, but also on knowing the condition of the levees protecting those citizens. Currently, a system is in place to provide accurate and frequent information on river stage at several reporting gauging stations. However, the system is not set up to provide information on the conditions of the levees themselves. Accurate and timely instructions and information are needed to alert the public of personal protective actions they can take.

Desired Outcome:

Development of a network of telemetered sensors (piezometers and Optical-Time-Domain Reflectometry) that will provide information on seepage pressures and levee movement. Such information will be extremely useful for coordinating emergency response.

Methodology:

Flood forecasting and warning would be supplemented by a system of telemetered sensors (piezometers and Optical-Time-Domain Reflectometry) that would record and transmit seepage pressure and monitor levee movement along critical levee reaches. This would provide comprehensive predictions of floods and warning of flood danger from overstressed levees. This system could be installed first in levees protecting urban areas and then could be expanded in the future to protect less populated areas.

CVFPP Goals

Contributes Significantly to: Improve Institutional Support

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☑ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☑ Improve Institutional Support
- ☐ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retain for further evaluation

Advantages:

- High potential for federal cost share.
- Would make flood fighting more effective.
- Would decrease costs of emergency response and recovery.
- Politically and institutionally very acceptable.

Disadvantages:

- Potentially high cost.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Low to moderate. Primary capital costs would consist of installing new early warning instrumentation. Due to the number of miles of levees, this could be moderately costly.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Knowing which levees are stressed during high water would help focus future O&M, thereby making it much more efficient.

Potential for Cost-Sharing?

High potential for Federal cost sharing via contributions to existing federal project purposes (flood control and water supply)

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Decrease. Improved levee early warning instrumentation would provide additional time for emergency response activities.

Flood fighting? (Increase, Decrease, or No Significant Change)

With improved levee early warning instrumentation, floodfighting activities such as sandbagging, constructing protective ring dikes, relocating valuable property, and evacuations could be coordinated in advance of levee breaks .

Effect on Damage to Critical Public Infrastructure?

Early warning instrumentation would provide more time for emergency preparedness and response of critical public infrastructure.

Effect on Floodplain and Economic Development?

No significant change.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Decrease. Potential to decrease State responsibility by reducing the consequences of flooding.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

None

Adverse Environmental Impact?

Installing a levee early warning system would result in minor temporary impacts to riparian and aquatic habitat.

Permitting Considerations?

None

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

None.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Political acceptability would likely be high across all levels of government. Institutional capacity to improve early warning instrumentation would reside in the State and Federal levels of government.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

None.

Technical Considerations:

Redirected Hydraulic Impacts?

Reduces residual risk by reducing the consequences of flooding.

Residual Risk?

None

Climate Change Adaptability:

Improving levee early warning instrumentation would provide early warning and notification to public safety officials.

Urban, Small Community, and Non-Urban Considerations:

All regions.

Regional Applicability:

Integration with Other Programs:

Integration with existing data collection system (CDEC)

References:

DRAFT Management Action Evaluation

Management Action Title: MA-069

Protect critical infrastructure corridors from flood waters.

Description:

Problem:

In many Central Valley communities, the infrastructure needed to facilitate the flow of resources into, or evacuees out of, a flooded area would be impacted or incapacitated in the event of a flood. Critical infrastructure includes transportation corridors (highways, roadways), power lines, railroads, gas lines, water supply treatment and distribution facilities (aqueducts, pumping stations), and others. For example, under various flood scenarios in the City of Sacramento, most transportation infrastructure (major highways, egress routes, lightrail, and Sacramento International Airport) would be partially or completely inundated during a large flood event or levee failure. This could hinder the orderly and timely evacuation of people, and impede access by emergency response personnel engaging in flood fighting, evacuation, or other emergency aid functions. In other areas, even if communities are not flooded they could become isolated if transportation corridors are flooded, posing public safety risks. Flooded transportation corridors could also impede the restoration of lifeline utility infrastructure (water, power, sewer, etc).

Desired Outcome:

Facilitate effective emergency response and recovery by protecting critical public infrastructure from flood waters.

Methodology:

The method for protecting critical infrastucture would vary depending upon the size and type of infrastructure, ownership (a high percentage of infrastructure is privately owned), location, and characteristics of the flood (depth, rapidity, velocity, time for floodwaters to recede). For example, vital transportation corridors (highways or railroads) could be protected by embankments or by elevation above flood waters. In another example, pumping stations for sewer or water utilities could be flood proofed and equipped with on-site backup power generators. Implementation should consider prioritization of infrastructure to be protected, both regionally and within individual communities, to maximize benefits and cost effectiveness.

CVFPP Goals

Contributes Significantly to: Improve Institutional Support

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☑ Improve Institutional Support
- ☐ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retain for further evaluation.

Advantages:

- Increases public safety.
- Improves evacuation/egress and emergency response during flood events.
- Reduces post-flood recovery time.

Disadvantages:

- High capital cost.
- Impacts would vary depending on type of infrastructure.

Economic Considerations:

Capital Cost? (High, Medium, Low)

High initial investment

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Little or no change to O&M costs

Potential for Cost-Sharing?

Uncertain potential for Federal cost sharing via contributions to existing Federal water resources project purposes (flood management), but existing Federal programs (FEMA's Hazard Mitigation Grants Program and the National Disaster Assistance Act) may provide funding sources

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Potential to reduce long-term costs for flood recovery through reduction in damage to infrastructure (transportation, power, water)

Flood fighting? (Increase, Decrease, or No Significant Change)

No change to flood fighting costs

Effect on Damage to Critical Public Infrastructure?

Directly reduces potential flood damage to critical public infrastructure

Effect on Floodplain and Economic Development?

No direct effects to floodplain development; potential to speed regional economic recovery after a flood event

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential to reduce State liability through reduction in damage to public and private infrastructure and improvement in ability to respond to floods (evacuation, emergency access, recovery)

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

None

Adverse Environmental Impact?

Site-specific, but potential substantial permanent impacts to terrestrial and potentially wetland and riparian habitats, including loss of habitat for special-status species

Permitting Considerations?

Extensive and complex

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Potential to increase public safety by keeping transportation routes open for emergency response, evacuation, and recover during and immediately after a flood event, and protecting other infrastructure necessary for timely flood recovery (water, power, gas, etc)

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

None

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Implementability would depend on size and type of infrastructure, ownership (federal, state, local), cost, and potential construction impacts (economic, social)

Technical Considerations:

Redirected Hydraulic Impacts?

No redirected hydraulic impacts

Residual Risk?

Reduces residual risks of flooding by preventing damage to critical infrastructure and speeding post-flood recovery

Climate Change Adaptability:

This action is unrelated to hydrologic and biological adaptability

Urban, Small Community, and Non-Urban Considerations:

Potential applicability in a variety of urban and small community environments

Regional Applicability:

Applicable in all regions where critical infrastructure and major transportation routes could be affected by flood waters

Integration with Other Programs:

Planning efforts should be coordinated/integrated with local and regional public safety plans (evacuation, mass care and shelter, medical response, post-disaster recovery, etc.); potential opportunities for implementation or funding through California Disaster Assistance Act, FEMA's Hazard Mitigation Grants Program or federal Natural Disaster Assistance Act, and/or insurance companies (to minimize insured losses).

References:

Delta Risk Management Strategy

DRAFT Management Action Evaluation

Management Action Title: MA-070

Expand the State's assistance to LMAs during flood emergencies.

Description:

Problem:

Funding available to finance O&M, repairs, and flood fighting varies widely across levee maintaining agencies, and many have a limited ability to raise funds (particularly during emergencies). For example, flood fight responders must often seek assistance or funding for rock, supplies, and technical expertise from the next level of local, State, or federal jurisdiction. Most available State and federal funding sources related to floods are aimed at reducing risk and potential damages in advance of a flood or reimbursing the appropriate jurisdiction for eligible emergency response work—not at helping finance operations during flood fights.

Desired Outcome:

Improve levee maintaining agencies' ability to quickly raise funds when a floods or other threats to levee stability are imminent.

Methodology:

Create a public loan guarantee program that would promise to assume maintenance districts' debts from loans obtained to help finance floodflights in the event that districts cannot repay them. This would allow even very small RDs and LDs to purchase the resources and expertise needed to help hold back floodwaters. There are also existing programs through Cal EMA and FEMA.

CVFPP Goals

Contributes Significantly to: Improve Institutional Support

Potentially Contributes to (Check all that apply):

- ☐ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☑ Improve Institutional Support
- ☐ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retain for further evaluation

Advantages:

- Directly benefits agencies responsible for maintaining flood management facilities.

Disadvantages:

- Sustainable funding source would need to be identified.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Low to high cost to implement, depending on type and magnitude of program

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

O&M costs would not change

Potential for Cost-Sharing?

Could increase State cost sharing in emergency management

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Could improve emergency response activities at local level

Flood fighting? (Increase, Decrease, or No Significant Change)

Could improve local agencies' ability to flood fight and conduct emergency activities

Effect on Damage to Critical Public Infrastructure?

Could minimize public infrastructure damage during disaster events.

Effect on Floodplain and Economic Development?

No direct effects

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Could reduce State responsibility that may result from flooding.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

None

Adverse Environmental Impact?

None

Permitting Considerations?

None

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

No direct effects, but increased funding for improvements would result in a flood management system that provides greater public safety

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

No direct effects

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Potential for broad public support, particularly at local level; would require the identification of sustainable funding, which may require changes to laws and regulations governing the generation of funds for flood system maintenance and repairs

Technical Considerations:

Redirected Hydraulic Impacts?

None

Residual Risk?

No direct effect on residual risk

Climate Change Adaptability:

No direct effects

Urban, Small Community, and Non-Urban Considerations:

No specific considerations identified

Regional Applicability:

Applicable to all regions.

Integration with Other Programs:

References:

Agricultural Stewardship White Paper; California Floodplain Management Task Force, 2002, Final Recommendations Report; USACE 2001 Sacramento and San Joaquin River Basins Comprehensive Study; Agricultural Stewardship Summary; RCR;

DRAFT Management Action Evaluation

Management Action Title: MA-071

Improve evacuation planning.

Description:

Problem:

Few local governments have prepared flood-specific evacuation plans, either locally or regionally. Some local jurisdictions have produced flood evacuation plans that identify the range of involved agencies and personnel, notification procedures, public and private transportation options, evacuation routes, and other related information for flood emergencies (City of Sacramento, 2008). Others integrate these plans into their overall emergency plans (Shasta County, 2000). Only a few jurisdictions have distilled flood emergency preparedness and evacuation information into succinct summaries easily accessible and understandable by the public (Tehama County, 2009; San Joaquin County, 2009).

Desired Outcome:

Increased coordination across emergency response agencies and greater public awareness of proper evacuation procedures to reduce loss of life during severe flood events.

Methodology:

Produce local flood evacuation plans that identify the range of involved agencies and personnel, notification procedures, public and private transportation options, and evacuation routes/procedures that are easily accessible and understood by the public. These plans should also consider ingress routes for flood fighters while an evacuation is occurring.

CVFPP Goals

Contributes Significantly to: Improve Institutional Support

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☑ Improve Institutional Support
- ☐ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retain for further evaluation.

Advantages:

- Low Capital Cost.
- Works well with other MAs.
- Likely to be politically popular.

Disadvantages:

- Limited funding and institutional capacity from small and non-urban communities to implement MA.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Low. Policy MAs will tend to have a substantially lower capital cost than other MAs which involve physical construction.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

No significant change.

Potential for Cost-Sharing?

Yes. Potential cost-sharing with LMAs and local governments for evacuation planning and training; federal cost sharing is uncertain under current federal grant/funding opportunities.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Decrease. Evacuation planning would improve coordination across all emergency response staff involved in evacuation. Improved public awareness of evacuation procedures would also reduce the need for sweeping by emergency response staff.

Flood fighting? (Increase, Decrease, or No Significant Change)

No direct effect, but consideration of ingress routes for flood fighting (as part of evacuating planning) could facilitate emergency response.

Effect on Damage to Critical Public Infrastructure?

No significant change.

Effect on Floodplain and Economic Development?

No significant change.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential decrease. Improved evacuation planning could reduce consequences of flooding but will not reduce the frequency of potential flood threats.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

None

Adverse Environmental Impact?

None

Permitting Considerations?

None

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Significantly improves public safety by preventing loss of life through improved emergency response coordination and more efficient evacuation during severe floods.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

None.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Likely to be politically acceptable at the State and local levels. Some smaller local governments may be limited in their funding and institutional capacity to create evacuation plans without additional assistance.

Technical Considerations:

Redirected Hydraulic Impacts?

None.

Residual Risk?

Reduces residual risk. Creating and coordinating evacuation procedures reduces the consequences of flooding (potential damages to life and property).

Climate Change Adaptability:

Unrelated to hydrologic and biological adaptability.

Urban, Small Community, and Non-Urban Considerations:

Although Small or non-urban communities would likely benefit the most from evacuation plans, they also have limited funding and institutional capacity to establish them.

Regional Applicability:

All regions.

Integration with Other Programs:

References:

City of Sacramento, 2008; Shasta County, 2000; Tehama County, 2009; San Joaquin County, 2009;

DRAFT Management Action Evaluation

Management Action Title: MA-072

Develop a post-flood recovery plan for the Central Valley and Delta to improve the coordination and efficiency of post-flood public assistance.

Description:

Problem:

Many existing Central Valley post-flood recovery plans and programs leave room for improvement in clarity and integration. The variability in flood emergency planning throughout the Central Valley's communities is mirrored in the range of comprehensive post-flood recovery plans documented. Where they exist, these plans are generally driven by the eligibility requirements of the Stafford Act. Debris removal and economic recovery operations are often conducted well after floods, but often only to the extent that they are eligible for federal reimbursement. Coordinating post-flood recovery activities can be difficult because the range of agencies with legal or voluntary responsibilities for disaster recovery often cross jurisdictions and levels of government.

Desired Outcome:

Development of a simple, direct, integrated plan of action for post-flood recovery would reduce confusion, clarify roles and responsibilities, and facilitate disaster recovery throughout the Central Valley and Delta.

Methodology:

It is more likely that post-flood recovery actions would be completed if the responsible person or agency is clearly identified prior to the occurrence of a disaster. A post-flood recovery plan should address levee repair, flood water evacuation, and property and infrastructure rehabilitation. This plan should cover Central Valley communities with greater than 1,000 people and legacy communities in the Delta.

CVFPP Goals

Contributes Significantly to: Improve Institutional Support

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☑ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☑ Improve Institutional Support
- ☐ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retain for further evaluation. It may not be practical to develop ONE post-flood recovery plan for the Central Valley and Delta. (May need to consider providing "guidelines" and funding for plan development. However, that would likely reduce the effectiveness of this MA.)Should investigate combining with other consolidated MAs in this category.State participation in this MA (funding, coordination, planning assistance) should not constitute State responsibility for implementation activities and their effects.

Advantages:

- Low capital cost.
- Reduces maintenance and repair costs for LMAs.
- Increases likelihood of completion of post-flood recovery actions.
- Improves effectiveness of recovery efforts and provides direction during post-flood confusion.

Disadvantages:

- Some smaller local governments may be limited in their funding and institutional capacity to develop and implement post-flood recovery plans.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Low. Policy MAs tend to have a substantially lower capital cost than other MAs which involve physical construction. Capital investments include funding for multiagency, multijurisdictional planning and development of post-flood recovery plans.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Decrease. Increased post-flood recovery planning prior to flood events reduces maintenance and repair costs for LMAs.

Potential for Cost-Sharing?

Yes. Potential cost-sharing with LMAs and local governments for post-flood recovery planning. Federal cost-sharing is uncertain under current federal grant/funding opportunities. Potential for State cost-sharing under existing grant programs.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Decrease. Improved post-flood recovery planning increases the efficiency and effectiveness of post-flood recovery efforts.

Flood fighting? (Increase, Decrease, or No Significant Change)

No significant change.

Effect on Damage to Critical Public Infrastructure?

Decrease. Post-flood recovery planning establishes roles and responsibilities for rehabilitation, repair, or replacement of critical public infrastructure (e.g., hospitals, communication centers, utilities, schools, government operations, transportation routes, etc.) damaged by flooding. Improvements in floodwater evacuation also help protect critical public infrastructure.

Effect on Floodplain and Economic Development?

No significant change.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Decrease. Improved post-flood recovery planning at the local level reduces the need for State government intervention, thus reducing State responsibility.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

None

Adverse Environmental Impact?

None

Permitting Considerations?

None

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Improvements in post-flood levee repair, floodwater evacuation, and rehabilitation of critical public infrastructure all improve public safety.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Faster repair and public re-opening of recreation lands and facilities damaged by floods.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Politically and publicly acceptable at State, regional, and local levels. Institutionally, there may be difficulties with ONE plan for the entire area (unless there is resolution of inconsistencies related to which agency is responsible for what activity in sub-areas). Some smaller local governments may be limited in their funding and institutional capacity to develop post-flood

recovery plans.

Technical Considerations:

Redirected Hydraulic Impacts?

None.

Residual Risk?

No reduction in residual risk.

Climate Change Adaptability:

Unrelated to hydrologic and biological adaptability.

Urban, Small Community, and Non-Urban Considerations:

Small or non-urban communities may have limited funding and institutional capacity to create post-flood recovery plans.

Regional Applicability:

All regions.

Integration with Other Programs:

Delta Flood Preparedness, Response and Recovery Project (HAFOO)

References:

USACE 2001 Sacramento and San Joaquin River Basins Comprehensive Study; Agricultural Stewardship White Paper; Agricultural Stewardship Summary; Boyle & Associates, 2008. Madera County Integrated Regional Water Management Plan;

DRAFT Management Action Evaluation

Management Action Title: MA-073

Streamline the post-flood permitting process for flood system repairs.

Description:

Problem:

Obtaining permits for post-flood system repairs involves coordination with multiple agencies that can exceed the budgets of smaller levee maintaining agencies. With multiple permits required for most maintenance and mitigation activities, and no central location for coordinating the process, obtaining the necessary permits often takes longer than the actual repairs.

Desired Outcome:

Reduced costs and time needed to complete system repairs can reduce future flood risk.

Methodology:

The process of obtaining permits for the repair of damaged structures should be streamlined and consolidated, to save time and money. Federal and State agencies involved in the permitting process should coordinate to develop a consistent permitting program that is easy to understand and comply with at the local level. Permit applications submitted to Federal and State agencies through the permitting program should have priority in the review process, allowing permits to be issued in a timely manner so that repairs of damaged levees could begin shortly after a flood event. In addition, the Board could establish a process for issuing a blanket permit for recovery type work following a high water event.

CVFPP Goals

Contributes Significantly to: Improve Institutional Support

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☑ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☑ Improve Institutional Support
- ☐ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retain for further evaluation.Should investigate combining with other consolidated MAs in this category.State participation in this MA (funding, coordination, planning assistance) should not constitute State responsibility for implementation activities and their effects.

Advantages:

- Reduces O&M costs for LMAs, possibly freeing up funding for more system repairs.
- Reduces the time required to begin post-flood repairs.

Disadvantages:

- Potential resistance from permitting agencies.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Medium. While policy MAs tend to have a substantially lower capital cost than other MAs which involve physical construction, significant interagency coordination (on the State and federal levels) is be required to streamline the permitting process for flood-system repairs.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Decrease. Obtaining permits represents a significant cost of operation, maintenance and repair activities. Streamlining the permitting process should reduce costs for LMAs.

Potential for Cost-Sharing?

Yes, potential for federal cost-sharing.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

If streamlining the permitting process results in more post-flood repairs, this will reduce the frequency of flooding and thereby reduce the long-term costs of emergency response and recovery.

Flood fighting? (Increase, Decrease, or No Significant Change)

If streamlining the permitting process results in more post-flood repairs, this will reduce the frequency of flooding and thereby reduce the long-term costs of emergency response and recovery.

Effect on Damage to Critical Public Infrastructure?

Region specific.

Effect on Floodplain and Economic Development?

No direct effects; however, if the repairs results in reducing the frequency of flooding and increasing the level of flood protection, floodplain development may be encouraged.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential decrease in State flood responsibility due to the repairs reducing the frequency of flooding.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

None

Adverse Environmental Impact?

None

Permitting Considerations?

None

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

If streamlining the permitting process results in more post-flood repairs, public safety is improved by reducing the frequency of future flooding.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

None.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Streamlining the permitting process should be very popular with LMAs because it would reduce the time and funding required to obtain permits. Likely to be politically and publicly acceptable. State and federal permitting agencies may oppose this effort if it appears to render permit requirements less stringent or infringe upon their authority or jurisdiction.

Technical Considerations:

Redirected Hydraulic Impacts?

None.

Residual Risk?

If streamlining the permitting process results in more post-flood repairs, the frequency of future flooding and therefore the residual risk would be reduced.

Climate Change Adaptability:

Unrelated to hydrologic and biological adaptability.

Urban, Small Community, and Non-Urban Considerations:

Smalll and non-urban communities would likely benefit the most from streamlining the permitting process because they tend to have less staff and funding available.

Regional Applicability:

All regions.

Integration with Other Programs:

Sacramento River Bank Protection Project (FMO), Sacramento-San Joaquin Erosion Repairs Program (FMO), Levee Stability Program (FMO)

References:

USACE 2001 Sacramento and San Joaquin River Basins Comprehensive Study;

DRAFT Management Action Evaluation

Management Action Title: MA-074

Increase flood risk awareness through outreach.

Description:

Problem:

Among the public there is a general lack of understanding of flood risk because of limited access to information, a false sense of security and an undefined responsibility for education. Many property owners assume that if they are outside of the 100-year floodplain they are safe. Some also wrongfully assume that 100-year-certified levees will protect them against any level of flooding. State, federal, and local flood control agencies have struggled to educate the public with a comprehensive and consistent message on flood management. Governments and flood control managers are generally more adept at operating and maintaining flood systems than communicating the needs and challenges of flood management to the public.

Desired Outcome:

To improve the public's awareness of flood risk and explain what households and businesses can do to reduce or mitigate risk to acceptable levels. Property owners will be made aware of their flood risks and the requirements associated with the use, buying and selling of their property. Increase tribal groups awareness of the risk of flooding and notify them on the available assistance programs. Increased awareness may also help build political support for necessary flood management activities.

Methodology:

DWR could expand outreach programs to include public service announcements or workshops that increase public awareness of floodplain values, flooding hazards, public safety, and hazard mitigation measures. Notify property owners of the flood risks associated with living behind a flood protection structure. Develop an interactive web site that would allow users to access detailed flood hazard maps. There are opportunities for outreach activities using already established media outlets, such as newspapers, news broadcasts, social media, etc. Students from K-12 should be educated about flood risks as a mandatory part of their curriculum, including flood protection system, flood risks, levees, and even elementary planning concepts. There are also opportunities for coordination and sharing knowledge between State and local flood managers. Sharing knowledge can improve political support for funding, construction, new legislation and emergency preparedness and response.

CVFPP Goals

Contributes Significantly to: Improve Institutional Support

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☑ Improve Institutional Support
- ☐ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retain for further evaluation

Advantages:

- Potential to reduce flood damage, reduce floodplain development, and increase public safety.
- Well-informed public is more likely to support land use decisions consistent with floodplain function.
- Relatively low cost.

Disadvantages:

- Does not idrectly reduce flood risk.
- Local agencies may have trouble with funding.
- Flood information will not be consistent without region-wide coordination.
- Costs of implementing a new education program may be a burden to some schools.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Low capital costs. Policy and Outreach MAs will tend to have a substantially lower capital cost than other MAs which involve physical construction. Example of capital investments include: Funding for training, education, and promoting awareness of flood risk among the public and those responsible for implementing floodplain management decisions.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Low to moderate costs depending on how often flood information is disseminated. Resources will need to be provided periodically for the State to conduct Community Assistant Visits (CAVs)and to reinstitute\ Community Assistance Contacts (CACs).

Potential for Cost-Sharing?

High potential for cost-sharing with local agencies, State, and federal agencies to increase public awareness of floodplain values, flooding hazards, public safety. Consequently, if the public and politicians see the value of emergency preparedness, then they will be more likely to support future flood management efforts.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Potential to decrease emergency response and recovery costs. Better characterization of flood risk in communities could compel communities to flood-proof their infrastructure (both in new construction and by retrofitting existing structures) which would reduce potential damage and need for recovery.

Flood fighting? (Increase, Decrease, or No Significant Change)

No change. This MA contributes to increasing public awareness of flood risk, not to flood fighting coordination.

Effect on Damage to Critical Public Infrastructure?

No change. This MA contributes to increasing public awareness of flood risk, not reducing flood risk.

Effect on Floodplain and Economic Development?

No change.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential to reduce long-term State Flood Responsibility by increasing public awareness

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

None

Adverse Environmental Impact?

None

Permitting Considerations?

None

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

This MA improves public safety by reducing the consequences of flooding. Improving and promoting flood education and awareness programs in communities could discourage communities from developing in floodplains. Often, the general public and politicians are not aware of the dangers of flooding, until an actual emergency occurs.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

No potential.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

High likelihood of implementation.

Technical Considerations:

Redirected Hydraulic Impacts?

No redirected hydraulic impacts.

Residual Risk?

Increasing public awareness has the potential to reduce the consequences of flooding, therefore reducing the residual risk.

Climate Change Adaptability:

This action is unrelated to hydrologic and biological adaptability.

Urban, Small Community, and Non-Urban Considerations:

Region specific (cannot determine at this time).

Regional Applicability:

All regions.

Integration with Other Programs:

NFIP Community Assistance Program (LRFMO), Annual Risk Notification (LRFMO), Implementing California Flood Legislation into Local Land Use Planning Handbook and associated public workshops (LRFMO)

References:

DRAFT Management Action Evaluation

Management Action Title: MA-075

Provide technical assistance to local agencies for compliance and grant application assistance.

Description:

Problem:

Many local agencies need assistance in pursuing Federal and State grants to mitigate flood risk. Local project not being implemented because of lack of knowledge about the available programs. Many State and federal agencies have funding sources to assist local jurisdictions with their flood risk issues . Within these agencies, there are multiple programs that locals are not completely familiar with. Providing a clear roadmap for the locals and assisting them through the process of identifying the best programs for their needs is a service that is not readily available at this time.

Desired Outcome:

Increase local jurisdiction participation and awareness of various State and Federal programs available. Increased participation and awareness in FEMA's Flood Mitigation Assistance (FMA) Program, FEMA's Pre-Disaster Mitigation grant program, and FEMA's Hazard Mitigation Grant Program. Stronger partnerships and participation with all levels of government to maximize resources in support of State and Federal programs.

Methodology:

Provide technical assistance to local agencies and practitioners to notify them of the availability of FMA grants and other Federal and State programs. FEMA's FMA Program was created with the goal of reducing or eliminating claims under the NFIP. FEMA provides FMA planning, project, and technical assistance grants to assist states and communities implement measures that reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insurable under the NFIP. In Fiscal Year 2009, $35,700,000 of funding was available for the FMA programs. California received $842,400 compared to the highest grant award of $5,193,300. Greater coordination at all levels of government to integrate programs at a local, State and Federal level. Since CalEMA oversees the program, DWR could enhance the partnership with CalEMA staff on publicizing the availability of the grants. This would allow DWR to enhance its awareness of the grants and disseminate grant information when applicable to its local partners.

CVFPP Goals

Contributes Significantly to: Improve Institutional Support

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☑ Improve Institutional Support
- ☐ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retain for further evaluation

Advantages:

- Providing assistance to localities for Federal grant (and other State grant, e.g., LLAP, FCP, YFFPP, etc.) applications can, if the grants are won, improve flood protection statewide on various levels while reducing the financial responsibility of the State.

Disadvantages:

- None.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Low. Outreach MAs tend to have a substantially lower capital cost (need more staff to accomplish)than other MAs which

involve physical construction.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Potential to reduce O&M costs; FMA grants are used to support programs that reduce long-term risk for flood damages. Improvements to the flood control system may reduce O&M costs. May require initial cost outlay for more staff.

Potential for Cost-Sharing?

Cost sharing is central to this MA; State provides assistance to localities applying for Federal grant money. Definite cost sharing opportunities at the local, State and Federal levels.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Potential to reduce emergency response and recovery costs. Increased technical assistance could improve compliance, floodplain management, land use decision making and ability to fund worthwhile projects. FMA grants are used to support programs that reduce long-term risk for flood damages (i.e., reducing frequency and/or consequences of flooding)

Flood fighting? (Increase, Decrease, or No Significant Change)

Potential to reduce flood fighting costs; FMA grants are used to support programs that reduce long-term risk for flood damages (i.e., reducing frequency and/or consequences of flooding)

Effect on Damage to Critical Public Infrastructure?

Potential to reduce risk to critical infrastructure; FMA grants (or other State and Federal grants) may be used develop protection measures for critical infrastructure elements.

Effect on Floodplain and Economic Development?

No change.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential to reduce long-term State Flood Responsibility if FMA grants (or other State and Federal grants)are used to improve the flood control system.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

None

Adverse Environmental Impact?

None

Permitting Considerations?

None

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Potential to increase public safety if FMA grants (or other State and Federal grants) are won and used to improve flood control and prevention projects intended to improve public safety.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

No potential.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

High likelihood of implementation; minimal costs for the State to assist localities in grant applications with large potential

benefits

Technical Considerations:

Redirected Hydraulic Impacts?

No redirected hydraulic impacts.

Residual Risk?

No direct impact on residual risk.

Climate Change Adaptability:

This action is unrelated to hydrologic and biological adaptability.

Urban, Small Community, and Non-Urban Considerations:

No specific considerations identified.

Regional Applicability:

All regions.

Integration with Other Programs:

NFIP Community Assistance Program (LRFMO), LFPZ Parcel Database (LRFMO), Annual Risk Notification (LRFMO), Flood Projects Office (FPO), building codes, CRS, general flood risk planning.

References:

California Floodplain Management Task Force, 2002, Final Recommendations Report;

DRAFT Management Action Evaluation

Management Action Title: MA-076

Assist in development of local flood management plan updates.

Description:

Problem:

Legislation signed in 2007 included new requirements for providing flood protection to urban and urbanizing areas in the Central Valley. The flood legislation establishes protection from a 200-year flood event (flood with a 1-in-200 chance of occurring in any year) as the minimum level of flood protection to be provided in urban and urbanizing areas by 2025. The Legislature sets deadlines for cities and counties in the Central Valley to amend their general plans and zoning ordinances to conform to the CVFPP within 24 months and 36 months, respectively, of its adoption by the Board. Once the general plan and zoning ordinance amendments are enacted, the approval of development agreements and subdivision maps is subject to restrictions in flood hazard zones. Some local agencies are limited in their capacity to comply with new requirements and may require institutional and technical support from the State.

Desired Outcome:

Create integrated planning and permit methods for local entities to ensure compliance with the 2012 CVFPP, including General Plan updates, local flood management plan updates, regional general permitting, NCCPs, and HCPs.

Methodology:

Within 24 months of adoption of the CVFPP, the State would adopt and integrate standards for use by local governments to ensure they are in compliance with applicable provisions of the CVFPP during General Plan and other planning document updates, such as specific terminology and criteria, i.e. what is a 200 year flood event. Within 36 months of CVFPP adoption, the State would adopt and integrate standards for use by local governments to ensure they are in compliance with applicable provisions of the CVFPP when local zoning amendments are enacted.

CVFPP Goals

Contributes Significantly to: Improve Institutional Support

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☑ Improve Institutional Support
- ☐ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained.

Advantages:

- Reduces flood risk.
- Discourages floodplain development.
- Establish consistency in planning policy.

Disadvantages:

- Some local agencies may require significant institutional and technical support.
- Rrequires large coordination efforts.
- 200-year flood protection may be unattainable for some areas, either for financial reasons, or site limitations, or possible environmental restrictions.

Economic Considerations:

Capital Cost? (High, Medium, Low)

No capital costs for standards development and plan amendments.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Little or no change to O&M costs for updating plans; secondary costs associated with new flood infrastructure could be high.

Potential for Cost-Sharing?

Potential for Federal cost sharing via contributions to existing Federal project purposes (flood management). Also potential for local cost sharing.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Likely to reduce long-term costs for emergency response and recovery through reduction in flood risk.

Flood fighting? (Increase, Decrease, or No Significant Change)

Could decrease urgency and extent of floodfighting by limiting areas of highest potential losses, allowing some areas that would otherwise be a priority for flood fighting to be given low or no priority.

Effect on Damage to Critical Public Infrastructure?

Potential to reduce damage to critical public infrastructure through reduction in flood risk.

Effect on Floodplain and Economic Development?

Potential reduction in floodplain development in high-risk areas due to changes in zoning ordinances.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential to reduce State flood responsibility through reduction in flood risk.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

Advanced mitigation planning and development of general permits could contribute to rehabilitation ecosystem functions by mitigating in advance of impacts, mitigating in large consolidated areas, and identifying the most suitable areas for habitat rehabilitation.

Adverse Environmental Impact?

None

Permitting Considerations?

None for development of plan updates; however, the plans will impact future permitting processes in the Central Valley

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Potential to increase safety through reduced flood risk.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Regulations and planning requirements have the potential to benefit water supply, water quality, ecosystem enhancement, recreation, and agricultural industry.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Implementation required by legislation.

Technical Considerations:

Redirected Hydraulic Impacts?

Measures associated with new planning requirements could shift flood flows onto downstream areas.

Residual Risk?

Potential to prevent increases in residual risk due to changes in zoning ordinances.

Climate Change Adaptability:

This action could enhance biological adaptability by increasing the ability of conservation actions to increase habitat extent, connectivity, complexity, and continuity across environmental gradients; and thus, enhance the ability of populations to handle and adjust to the consequences of climate change.

Urban, Small Community, and Non-Urban Considerations:

Region specific (cannot determine at this time).

Regional Applicability:

Applicable in all regions affected by legislation.

Integration with Other Programs:

Implementing California Flood Legislation into Local Land Use Planning Handbook for Local Communities (and associated public workshops)

References:

RCR

DRAFT Management Action Evaluation

Management Action Title: MA-077

Improve awareness of Community Rating System insurance-rate adjusting program.

Description:

Problem:

The Community Rating System (CRS) was created to encourage and recognize communities that engage in floodplain management activities that exceed minimum National Flood Insurance Program (NFIP) standards. Despite the reduction in flood insurance premiums offered to participating communities, only 14% of California communities (accounts for 55% of the NFIP policy base statewide) are participating in the CRS program. Communities lack staff and time to apply and maintain program requirements.

Desired Outcome:

To increase participation and existing CRS classifications in the CRS program.

Methodology:

DWR recently hired a CRS Program Coordinator who is creating a strategic plan with a national CRS expert. If additional information is needed, please contact Dave Rolph,drolph@water.ca.gov

CVFPP Goals

Contributes Significantly to: Improve Institutional Support

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☑ Improve Institutional Support
- ☐ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained

Advantages:

- Encourages local communities to participate in the CRS program while their residents receive a reduction in NFIP insurance premiums.
- Residents also benefit from improved public safety and greater property protection.

Disadvantages:

- Initial coordination could be cumbersome and time consuming, but should not be problematic long term.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Low, the only costs associated with this action would be the creation of a CRS Coordinator position at the State level and outreach and training costs to educate the public and local agencies about the advantages of participating in the CRS program.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Low

Potential for Cost-Sharing?

Potential for cost-sharing with local agencies that work with or receive assistance from the CRS Coordinator's office. Should also coordinate with FEMA.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Decrease, encouraging more local entities to participate in the CRS program will decrease long-term flooding costs because the CRS communities will have better floodplain management programs.

Flood fighting? (Increase, Decrease, or No Significant Change)

NA

Effect on Damage to Critical Public Infrastructure?

Improves overall decisions on building new structures, including critical facilities.

Effect on Floodplain and Economic Development?

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Requires stricter floodplain management, thereby decreasing flood risk losses and increasing public safety.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

Could improve key physical and ecological functions through stricter requirements.

Adverse Environmental Impact?

None

Permitting Considerations?

Improves permitting process through stricter building requirements.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

CRS encourages better floodplain management, land use decisions, education and outreach within the community with the intent of increasing public safety. Participating in CRS by default increases the protection provided to communities because their flood protection will exceed what is necessary by NFIP standards.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

CRS communities in general, incorporate open space preservation, retention basin, parks and rec. decisions into their floodplain management.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

This action would be easy to implement. There are other State/local programs where coordination regarding education and outreach already occur and these could be used as a model. High, great support at the local, State and Federal level for the CRS program. Also high level of public support for this program.

Technical Considerations:

Redirected Hydraulic Impacts?

NA

Residual Risk?

CRS participation would reduce residual risk for participating communities because they would have increased flood protection.

Climate Change Adaptability:

Floodplain management considers the effects of climate change.

Urban, Small Community, and Non-Urban Considerations:

This would apply similarly to all community sizes and types, but less applicable in non-urban situations.

Regional Applicability:

All regions

Integration with Other Programs:

NFIP and Technical Support including the NFIP Community Rating System Program (LRFMO)

References:

California Floodplain Management Task Force, 2002, Final Recommendations Report; USACE 2001 Sacramento and San Joaquin River Basins Comprehensive Study; RCR;

DRAFT Management Action Evaluation

Management Action Title: MA-078

Develop mandatory flood insurance programs that are consistent with the risk of flooding.

Description:

Problem:

Under the current rules of the National Flood Insurance Program (NFIP), homes protected by levees certified by the USACE as providing one-percent chance event flood protection are not required to obtain flood insurance. For insurance purposes, these structures are considered to be outside the one-percent chance event floodplain. However, floodplain occupants situated behind levees are still exposed to a residual risk from flooding due to unforeseen factors such as poor construction, poor maintenance, undetected rodent activity, undetected geotechnical problems, or seismic events. Furthermore, while levees reduce the occurrence of flooding, they do not protect against the consequences of more severe floods. For example, a home built behind a levee designed to provide 100-year flood protection is at greater risk than a home built to the 100-year flood elevation. The home behind the levee could become completely inundated from a flood that exceeds 100-year levels.

Desired Outcome:

Develop a State sponsored insurance program so that those subject to residual flood risk are protected by flood insurance. Encourage property owners in all flood zones to carry flood insurance.

Methodology:

Create a flood hazard zone for areas behind credited levees, where Federal flood insurance would be mandatory and new buildings sited within the zone would pay actuarial based insurance rates. Encourage FEMA to establish a mandated flood insurance program for homes behind levees with preferred risk options and for structures protected from less than the 0.5% chance event floodplain. Graduate Federal flood insurance premiums according to a structure's level of flood risk rather than the structure's location. Additional information besides Flood Insurance Rate Maps (FIRMs) should be used for decision making. All public agencies not subject to local government floodplain management requirements or the Governor's Executive Order on Floodplain Management should comply with NFIP requirements. The State should consider developing a proposal to FEMA that would allow some relief from its policies, perhaps in the SPFCPA, in return for certain state assurances. This requires close coordination at Federal, State and local levels. Partnership with the Department of Insurance is needed.

CVFPP Goals

Contributes Significantly to: Improve Institutional Support

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☑ Improve Institutional Support
- ☐ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained

Advantages:

- Increases public safety and reduces loss to property.
- Provides a more realistic assessment of flood risk.

Disadvantages:

- Coordination between Federal, State and local agencies can be problematic.
- Could also increase costs for some people in "new" areas of flood risk.
- There will be some public resistance to a mandatory program, especially by those in established neighborhoods that have not had to purchase flood insurance in the past.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Variable, depending on the geographical extent of areas requiring flood insurance based on new flood risk zones.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

NA

Potential for Cost-Sharing?

Potential for cost share with the State, possibly in areas that receive protection from SPFC facilities or Federal facilities for which the State has provided assurances.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Decrease, recovery costs would be decreased because flood risk would be reevaluated based on protection provided for structures and not their physical location.

Flood fighting? (Increase, Decrease, or No Significant Change)

NA

Effect on Damage to Critical Public Infrastructure?

Depends on how many critical facilities are currently benefiting from some level of protection from levees.

Effect on Floodplain and Economic Development?

This could discourage floodplain development if insurance rates are changed to better reflect a structures flood risk. Would encourage better building standards behind levees and possibly limit construction in these areas depending on building regulations and insurance requirements

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential to increase or decrease state flood responsibility if areas protected by the SPFC area amended due to changes in the way flood risk is evaluated. Dependent upon final regulations - needs further evaluation.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

could affect physical and ecological functions.

Adverse Environmental Impact?

None

Permitting Considerations?

Permitting decisions would be impacted in areas behind levees.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Improvements to public safety overall.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potentially could impact decisions concerning open space, parks and rec. etc.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

This could be difficult to implement. FEMA and the state would need to cooperate and possible change the way flood risk is

determined and the rates that should be paid for protection. This could also cause some people who were not previously considered in a flood risk area to now be required to buy flood insurance. Politically sensitive subject requiring high level coordination of Federal, State and local level. Similar proposal proposed at Federal level.

Technical Considerations:

Redirected Hydraulic Impacts?

NA

Residual Risk?

This should reduce residual risk by protecting homes at risk for flooding based on protection provided and not just their geographic location.

Climate Change Adaptability:

This action is unrelated to hydrologic and biological adaptability.

Urban, Small Community, and Non-Urban Considerations:

This would apply similarly to all community sizes and types.

Regional Applicability:

All regions

Integration with Other Programs:

Map Modernization Program (FEMA), Risk MAP Program (FEMA), Provisionally Accredited Levees Program (FEMA), NFIP and Technical Support (LRFMO)

References:

California Floodplain Management Task Force, 2002, Final Recommendations Report; USACE 2001 Sacramento and San Joaquin River Basins Comprehensive Study; Flood Warning: Responding to California's Flood Crisis.;

DRAFT Management Action Evaluation

Management Action Title: MA-079

Increase public understanding of FEMA maps and policies.

Description:

Problem:

Floodplain maps are often the main resources used by the public and decision makers to understand flood risks. Floodplain boundaries often change, pushing properties once thought to be outside a flood hazard area inside a special flood hazard area. Shifting properties in and out of floodplains sends conflicting messages to the public about flood risk and can undermine the credibility of floodplain maps in the eyes of the public. While the public's lack of flood awareness can be partially attributed to constantly evolving and confusing floodplain maps, the public also bears responsibility for underestimating the risks of flooding.

Desired Outcome:

Provide better flood risk education to the public regarding FEMA responsibilities and policies, how FEMA regulations affect their property, and how these policies relate to State programs.

Methodology:

Establish a collaborative, multi-agency technical committee to educate and engage the public and governmental agencies on achieving tolerable levels of flood risk. Work with FEMA/NFIP, other State and local agencies and governments on outreach, education and awareness programs.

CVFPP Goals

Contributes Significantly to: Improve Institutional Support

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☑ Improve Institutional Support
- ☐ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained

Advantages:

• Improved flood risk understanding would go a long way to create goodwill and increase cooperation with FEMA and the State by landowners.

Disadvantages:

• There will be costs associated with public outreach and education.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Low, the primary costs with this action would be outreach and education activities, to educate people about their flood risk and how FEMA maps are developed and used to assess their risk.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Low

Potential for Cost-Sharing?

Potential for cost share among agencies for outreach activities.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Better education may contribute to decreased cost for emergency response and recovery.

Flood fighting? (Increase, Decrease, or No Significant Change)

NA

Effect on Damage to Critical Public Infrastructure?

Education on flood risk and justification for location of critical infrastructure could help alleviate economic impacts.

Effect on Floodplain and Economic Development?

Better education improves decision making (i.e., building in the floodplain and economic impacts).

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Improved understanding of flood risk provides support for stronger floodplain management lessening damages and potentially the State's liability.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

Could improve key physical and ecological functions.

Adverse Environmental Impact?

None

Permitting Considerations?

May positively impact the permitting process in communities.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

A better educated public can take action to improve their own safety.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Improved education provides foundation for property owners participating on committees etc., who are making land use decisions.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

This action would be easy to implement because it would primarily involve education and outreach activities

Technical Considerations:

Redirected Hydraulic Impacts?

NA

Residual Risk?

Lowers potential of residual flood risk through education, outreach and awareness programs targeted at property owners.

Climate Change Adaptability:

Urban, Small Community, and Non-Urban Considerations:

This would apply similarly to all community sizes and types.

Regional Applicability:

All regions

Integration with Other Programs:

Should be integrated and coordinated with all other outreach, education and awareness programs at the Federal, State and local level, including NFIP Community Assistance Program (LRFMO)

References:

Flood Warning: Responding to California's Flood Crisis.;

DRAFT Management Action Evaluation

Management Action Title: MA-080

Eliminate subsidies for structures that are repetitively damaged.

Description:

Problem:

Desired Outcome:

To reduce flood insurance liability and reduce the loss of lives and property and tax burden to State and Federal taxpayers.

Methodology:

Terminate Federal flood insurance for property owners who have accumulated claim reimbursements equal to or greater than the value of the structure or require reimbursements to be used towards flood mitigation measures such as relocating, elevating structures, flood proofing, or demolition if the structure is repetitively or substantially damaged. This will require coordination with FEMA/NFIP and local communities to implement. We should also research and publicize the availability of FEMA grants that target the removal or elevation of "Repetitive Loss" structures, specifically the Severe Repetitive Loss, Flood Mitigation Assistance grants, and Repetitive Flood Claims Program.

CVFPP Goals

Contributes Significantly to: Improve Institutional Support

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☑ Improve Institutional Support
- ☐ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained

Advantages:

- Overall improved protection of lives and property over the long term.
- Money not spent on repetitively damaged structures can go to other programs and assistance.

Disadvantages:

- Not politically or publicly popular.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Low/medium, this management action would save money by reducing the amount that can be paid for repetitively damaged structures by the NFIP but may require some funds for mitigation.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Initial annual cost would be greater in first few years until program was fully phased in and benefits realized.

Potential for Cost-Sharing?

Federal, State and local cost sharing opportunities.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Decrease, recovery costs would be decreased by this action. By limiting repetitive reimbursement for damages or forcing the use of repetitively damaged property reimbursements for relocation, etc. recovery costs will be reduced.

Flood fighting? (Increase, Decrease, or No Significant Change)

NA

Effect on Damage to Critical Public Infrastructure?

Presumably few critical facilities are qualifying repetitive loss structures.

Effect on Floodplain and Economic Development?

This could affect floodplain development by reducing the construction of structures that could be repetitively damaged due to flood risk.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Decreases State flood responsibility by decreasing number of repetitive loss structures.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

None

Adverse Environmental Impact?

None

Permitting Considerations?

None

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Definite improvement to public safety. Improves permitting process through stricter building requirements and floodplain management standards.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

There may be resistance to this action because many payees will resist moving their structure or the redirection of insurance payments to other flood management activities. This will require a major policy change to enact. This has already been proposed at the Federal level and is met with significant political challenges.

Technical Considerations:

Redirected Hydraulic Impacts?

NA

Residual Risk?

This should reduce residual risk by providing incentives to relocate structures out of areas of repeated inundation or high risk.

Climate Change Adaptability:

This action is unrelated to hydrologic and biological adaptability.

Urban, Small Community, and Non-Urban Considerations:

This would be more difficult to implement in smaller communities with less resources.

Regional Applicability:

All regions

Integration with Other Programs:

Beneficial to coordinate with other programs at the Federal, State and local levels.

References:

USACE 2001 Sacramento and San Joaquin River Basins Comprehensive Study; Uniform Hazard Mitigation Assistance, CalEMA's Hazard Mitigation Web Portal,www.calema.ca.gov.

DRAFT Management Action Evaluation

Management Action Title: MA-081

Purchase and position flood fighting materials in preparation for a flood event.

Description:

Problem:

During a flood event, considerable quantities of floodfighting materials (e.g., rock, sandbags, lumber, sheetpiles, other supplies) are often needed with minimal advance notice. Waiting until an event occurs to locate, purchase, and transport materials (mobilizing barges or other transportation) can slow the response to a flood emergency, especially one that requires more than basic sandbagging and levee patrol. In addition, during an event, the ability of local agencies to obtain loans to support purchasing and positioning materials is limited because banks are reluctant to lend when the tax base used to repay those loans is itself at risk.

Desired Outcome:

Purchasing and positioning floodfighting materials prior to a flood event can reduce emergency costs and damages associated with a lack of timely access to those materials.

Methodology:

Floodfighting materials could be purchased in advance of flood events and stockpiled at materials storage and transfer facilities. These material storage and transfer facilities could be located both locally (for immediate access) and regionally (near barge loading facilities or protected transportation corridors) and stocked based on assumptions related to the magnitude of flood event for which a response is desired, miles of levees supported, etc. Stockpiles could be managed by both DWR and local agencies to provide access to bulk materials (rock, lumber, sheetpile) and portable materials (sandbags, plastic, etc.). Development of mutual aid agreements that facilitate the coordination and sharing of floodfighting materials could also be facilitated to leverage available funding (state, federal, regional, local) and supply resources.

CVFPP Goals

Contributes Significantly to: Improve Institutional Support

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Institutional Support
- ☐ Improve Operation and Maintenance
- ☐ Promote Multi-Benefit Projects
- ☑ Promote Ecosystem Functions

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retain for further evaluation.Should investigate combining with other consolidated MAs in this category.State participation in this MA (funding, coordination, planning assistance) should not constitute State responsibility for the materials, their upkeep, or their use.

Advantages:

- Greatly increases availability and accessibility of flood fighting materials, especially for communities that lack easy access to these materials.
- DWR has implemented similar existing programs in the past that this MA could build off of.

Disadvantages:

- High capital costs. Long-term storage and upkeep costs.

Economic Considerations:

Capital Cost? (High, Medium, Low)

High. Majority of costs are upfront capital expenditures.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Slight increase related to storage and upkeep of floodfighting materials.

Potential for Cost-Sharing?

Yes. Potential cost-sharing with local, regional, state, and federal agencies for purchase and storage of materials.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Decrease. Access to and effective use of floodfighting materials may reduce potential for damages and need for recovery.

Flood fighting? (Increase, Decrease, or No Significant Change)

Decrease. Prepurchased flood fight supplies reduce the need for purchases made with emergency loans. Depending on the storage location, transporting the materials may still incur some costs.

Effect on Damage to Critical Public Infrastructure?

Decrease, in some cases. Ensuring the accessibility and availability of floodfighting materials may hold off a flood or allow responders to prevent damage where an egress route occurs on top of a levee, for instance.

Effect on Floodplain and Economic Development?

No significant change.

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Potential decrease. Accessibility and availability of materials improve floodfighting and thereby reduce the magnitude and frequency of flooding.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

None

Adverse Environmental Impact?

None

Permitting Considerations?

None

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Potentially improves public safety by improving ability to respond to threats to levee stability, thus reducing chance of levee failure.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Improved floodfighting may protect nearby resources.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

High capital cost may reduce political and institutional support .

Technical Considerations:

Redirected Hydraulic Impacts?

Potential for redirected impacts (if not implemented in a coordinated manner and systemwide).

Residual Risk?

Reduces residual risk by enhancing responders' ability to quickly react to threats to levee stability, thus reducing chance of levee failures.

Climate Change Adaptability:

Adaptable to climate change, as floodfighting materials positioning could take into account the future impacts of climate change.

Urban, Small Community, and Non-Urban Considerations:

Especially important for small and non-urban communities whose LMAs may have the most difficulty procuring supplies under current conditions.

Regional Applicability:

All regions, though storing or transporting floodfighting materials may be easier in some regions where waterways could accommodate barges (Upper Sac, Lower Sac, Delta) than in others where waterways are harder to navigate (Upper San Joaquin).

Integration with Other Programs:

Flood Fight Materials and Equipment Storage Program (HAFOO)

References:

Delta Risk Management Strategy;

DRAFT Management Action Evaluation

Management Action Title: MA-082

Compensate rural areas for accepting lesser flood protection than urban areas.

Description:

Problem:

Many rural and agricultural communities are concerned that improvements to urban flood protection over the past few decades have already resulted in "tiered" flood protection levels, or have come at the expense of rural flood protection. The agricultural community asserts that relatively lower flood protection levels in rural and agricultural areas could benefit urban residents to the detriment of the economic fitness and viability of these rural communities. Requirements for increased flood protection in urban and urbanizing areas raise concerns that rural communities could potentially be asked to further sacrifice their lands and their livelihoods in the process of improving urban flood protection. At the same time, mechanisms are needed to help rural communities recover from floods and maintain agricultural viability.

Desired Outcome:

Create economic incentives for rural areas to accommodate floods in order to protect urban areas.

Methodology:

Develop funding mechanisms for rural areas to address the challenges tied to accepting or assuming comparatively lower levels of flood protection than urban and urbanizing areas. Reliable funding is essential for agricultural communities and areas to develop and implement flood management and recovery plans, store equipment, train community members in flood emergencies and flood fighting, and conduct levee maintenance and repairs. Such programs could provide benefits to both urban areas that are required to provide higher levels of flood protection, as well as rural areas that struggle to maintain existing flood management facilities and justify the costs for improvements. Federal programs providing assistance to farmers and farm businesses should also be closely looked at to eliminate duplication of government assistance.

CVFPP Goals

Contributes Significantly to: Improve Institutional Support

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☐ Improve Institutional Support
- ☐ Improve Operation and Maintenance
- ☐ Promote Multi-Benefit Projects
- ☑ Promote Ecosystem Functions

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retain for further evaluation

Advantages:

- Low cost to implement initially (mechanism or program)
- Potential for significant long-term benefits (promotes sustainable flood management).
- Could promote agricultural stewardship and sustainability.
- Increase level of post disaster State funding.

Disadvantages:

- Sustainable funding source would need to be identified
- Land owners may not participate in a voluntary program
- Rural areas will have less flood protection than urban areas.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Low capital costs. No structural facilities are required. Post flood costs could be significant.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

O&M costs would not change

Potential for Cost-Sharing?

Potential for federal cost sharing based on existing federal purposes (flood management). Flood disaster assistance programs such as USDA and SBA.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Requires further evaluation to determine effects on emergency response and recovery costs. Could be significant. Federal program should be evaluated for cost comparison.

Flood fighting? (Increase, Decrease, or No Significant Change)

Requires further evaluation to determine effects on flood fighting

Effect on Damage to Critical Public Infrastructure?

Flooding rural area would require repair of such levees afterward.

Effect on Floodplain and Economic Development?

Potential to reduce new development in currently rural floodplains

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

Requires further evaluation to determine effects; reduced state flood responsibility in urban areas may be offset by increased responsibility in rural areas accepting flood flows, depending on implementation

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

None

Adverse Environmental Impact?

None

Permitting Considerations?

None

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

Potential to directly improve public safety in urban areas; potential to indirectly improve public safety in rural areas accepting flood flows through increased understanding of flood risk (particularly in combination with management actions to address the effects of flooding when it does occur), but there may be a greater chance of flooding in rural areas.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

No direct effects, but potential to provide benefits associated with non-urban uses of floodplains (agriculture, open space, recreation, environmental restoration)

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Agricultural communities have expressed willingness to discuss programs that would provide financial compensation for reduced level of protection; program would need to consider long-term economic impacts, appropriate means to support recovery of agriculture and other rural industries after floods occur

Technical Considerations:

Redirected Hydraulic Impacts?

None

Residual Risk?

No direct effect on residual risk; however, could indirectly reduce residual risks in rural areas if implemented in combination with other actions to mitigate the consequences of flooding once it occurs

Climate Change Adaptability:

None

Urban, Small Community, and Non-Urban Considerations:

May provide a means for compensating rural communities for flooding

Regional Applicability:

Applicable to all regions.

Integration with Other Programs:

References:

Agricultural Stewardship White Paper;

DRAFT Management Action Evaluation

Management Action Title: MA-083

Effectively maintain and operate closure structures.

Description:

Problem:

The levee control system is not a continuous embankment with a well defined and established levee crown elevation throughout. Throughout the system, levees are interrupted by crossings and other at-grade penetrations that lower the top-of-levee elevation. Such crossings include railroad tracks, roads and highways. Many of these levee gaps are fitted with structures that would be closed during periods of high water to prevent inundation of the protected area. Other gaps do not have such closure structures. Some closure structures installed have not been maintained to allow functional operation during flood events.

Desired Outcome:

All gaps in levee alignment will be evaluated periodically. and new closure structures will be installed at gaps where warranted. All closure structures will be operated and inspected at pre-established regular intervals to ensure the structures will function during flood events.

Methodology:

All gaps on the levee control system need to be identified, and local agencies must evaluate gaps without closure structures to assess whether a structure is warranted. Existing closure structures need to be evaluated for deficiencies in design and maintenance and need to be operated on a regular basis to make sure they will operate effectively during emergencies. For each existing or potential structure, the structure operator(s) and affected transportation corridor must be identified. The State needs to establish closure structure operation drill and inspection protocols to be carried out by local structure operators.

CVFPP Goals

Contributes Significantly to: Improve Operation and Maintenance

Potentially Contributes to (Check all that apply):

- ☑ Improve Flood Risk Management
- ☑ Improve Operation and Maintenance
- ☐ Promote Ecosystem Functions
- ☐ Improve Institutional Support
- ☐ Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained/Requires Further Evaluation):

Retained for further evaluation.

Advantages:

Closure structures in good conditions and with available crews to activate them are effective in preventing inundation.

Disadvantages:

Time, money and coordination required to activate and erect the structures. Disruption in transportation.

Economic Considerations:

Capital Cost? (High, Medium, Low)

Low. Closure structures are not expensive to design and install. The cost to upgrade existing structures is equally low.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Very low. Annual costs are associated with operational drills and upgrades to the closure structures.

Potential for Cost-Sharing?

Potential for cost sharing with local agencies and Federal flood agencies.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Significant Change)

Low. Criteria and a well established protocol for activation of closure structures should be included in any emergency response plan. Although closure structures often block transportation routes, which may be used for evacuation, coordinating structure operations protocol with emergency response plans is likely to reduce the need for or frequency of evacuations.

Flood fighting? (Increase, Decrease, or No Significant Change)

Flood fighting must be exercised on system gaps that do not have closure structures, so this action would reduce flood fighting costs.

Effect on Damage to Critical Public Infrastructure?

Failure to effectively close gaps may result in inundation of a protected area and potential damage to any infrastructure lying within.

Effect on Floodplain and Economic Development?

None

Effect on State Flood Responsibility? (Increase, Decrease, or No Significant Change)

While the State may not be directly responsible for the operation and maintenance of closure structures, it is in the State's interest to make sure that closure structures will successfully operate and close off levee gaps to prevent inundation during high-water events.

Environmental Considerations:

Rehabilitate key physical processes and ecological functions?

None

Adverse Environmental Impact?

None

Permitting Considerations?

Drill and/or emergency operation of closure structures may require permits and coordination with agencies and other entities affected by the structure, such as the California Department of Transportation, counties and municipalities, and rail companies.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of FM System?

None

Social Considerations:

Public Safety?

High potential to reduce the consequences of flooding and to protect public safety by preventing inundation.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

None

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Very likely. Existing closure structures may need to be upgraded and all need to be operated on a regular basis. The USACE requires that all closure structures be in good conditions and that trial erections have been accomplished in accordance with related O&M manuals.

Technical Considerations:

Redirected Hydraulic Impacts?

None

Residual Risk?

Failure to recognize gaps in the system and ensure operation of closure structures will increase the residual risk.

Climate Change Adaptability:

None

Urban, Small Community, and Non-Urban Considerations:

Operation of closure structures (during trials and emergencies) is likely to disrupt the transportation network. Activation of closure structures is a consorted effort between the operator and transportation entities affected by the closure.

Regional Applicability:

Applicable to all regions.

Integration with Other Programs:

None

References: